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**A PARADIGM FOR CONFERENCE COLLABORATION
ACROSS A GLOBALLY NETWORKED ENVIRONMENT**

by

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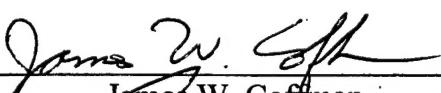
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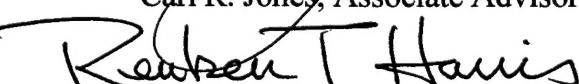
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ABSTRACT

Manual, labor intensive efforts are traditionally required to plan professional conferences and symposiums. Methods for receiving, verifying, recording, sorting and scheduling papers and presentations continue to rely heavily on administrative personnel resources. In recent years, some electronic methods have been incorporated into the conference planning process, but there have been no efforts to provide an integrated collaboration system which takes full advantage of the existing Internet architecture. Advances in World Wide Web technology provide an opportunity to revolutionize the entire conference planning process. For the 1998 IEEE International Symposium on Circuits and Systems (ISCAS '98), a prototype is built to demonstrate and evaluate the effectiveness in using Internet technology to provide an automated system for conference collaboration. Use of this prototype throughout the ISCAS conference planning effort clearly identifies the on-line requirements which are essential to support a globally networked collaboration environment.

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I. INTRODUCTION

This thesis proposes the use of current Internet technology to develop a global collaboration environment to replace the traditional methods for conference planning and organization. An empirical prototype was developed and used to coordinate the 1998 IEEE International Symposium on Circuits and Systems (ISCAS '98) and to demonstrate and evaluate the effectiveness of this methodology.

A. BACKGROUND

Manual, labor intensive methods are traditionally used to plan conferences and symposiums. A large portion of the coordinating effort is attributable to the paper submission and review processes. The submission process begins with prospective authors mailing multiple copies of their proposed papers to the conference planning committee. The papers are received, verified, recorded and sorted by administrative personnel. An acknowledgment is mailed to each author to confirm their submissions. The review process begins by mailing multiple copies of the received papers to various designated reviewers along with review forms for their use in evaluating the papers. The reviewers read the papers before completing and returning the forms. The completed forms are collected and used by the Technical Program Committee (TPC) to select the papers which will be presented during the conference. All of the accepted papers are then scheduled into sessions by topic. The authors of the accepted papers are notified to submit final versions of their papers and to register for the conference. These final papers are then sent to be published in the conference proceedings.

In recent years, electronic means have been incorporated into various individual aspects of the overall conference planning process. File Transfer Protocol (FTP) servers have been used to support the receipt and distribution of electronic papers while formatted e-mail review forms have been used to support the review process [Ref. 1]. Also, electronic mail (e-mail) has been used for receiving paper submissions as well as for distributing the

papers to the reviewers [Ref. 2]. Although these electronic techniques have enhanced some of the conference processes, there has been no effort to provide an integrated system using interactive applications for automating information storage and retrieval in most or all conference processes.

B. AREA OF RESEARCH

The primary objective for this thesis is to evaluate the feasibility of using the World Wide Web (WWW, or Web) to deploy an integrated suite of conference organization and collaboration applications. The scope of this research will include the use of a database as a back end, or data source, for the Web applications to provide automated on-line data storage and retrieval. This will result in the integration of a Web server with a database server to support the interactive application requirements which are essential for providing an on-line conference collaboration environment.

C. PRIMARY RESEARCH QUESTIONS

- Which conference processes can be Web-enabled?
- Which conference processes are best suited to Web deployment?
- What are the hardware and software support requirements?
- Is scalability an issue with regard to hardware and software?
- Are there any special considerations for a Web deployed system?

D. DISCUSSION

Using current Internet technology, an interactive and automated system will be developed and evaluated for effectiveness in replacing the traditional methods used for conference organization - particularly those related to receiving, processing, distributing and reviewing papers submitted for conference presentation. The 1998 IEEE International

Symposium on Circuits and Systems (ISCAS '98) will be hosted by the Naval Postgraduate School in May and June of 1998. The Circuits and Systems Society is the oldest and largest professional organization in the IEEE. Their annual conference is one of the largest of its kind. Several of the ISCAS '98 conference support processes will be integrated into a Web-based prototype which will be used to coordinate the ISCAS conference planning activities over the Internet.

The objective of the ISCAS '98 prototype is to pipeline all of the conference organization processes into an integrated on-line collaboration environment. This prototype is designed to use a Web interface to provide a network distributed paper submission and review system for managing the various aspects of conference organization. The prototype allows any user (author, reviewer or committee member) to perform required tasks and/or to access essential information from globally remote locations via the Internet with the use of standard Web browser software. This thesis provides an overview of the ISCAS prototype development and analyzes the results and conclusions derived from the research efforts.

E. BENEFITS OF STUDY

This research will provide lessons learned and an initial prototype from which a globally networked conference collaboration system can be developed. Many of the processes related to the ISCAS prototyping effort can also be abstracted into other Internet/Intranet applications. In particular, the fundamental ISCAS applications are directly related to Electronic Commerce / Electronic Data Interchange (EC/EDI) functions and can easily be applied to highly formalized government activities like the DOD's sealed bidding process. The prototype's integration of database and Web technology will further demonstrate the capability for converting paper-based forms activities into interactive Web-form based processes which lead to a disintermediation of administrative requirements. For the Naval Postgraduate School, two such activities which could benefit from this research are student course registrations and submission of Student Opinion Forms (SOFs).

F. SUMMARY OF REMAINING CHAPTERS

Chapter II describes the resources and identifies the requirements for the ISCAS prototyping effort. The chapter includes a discussion on previous work for the conference in addition to the user and process requirements for interacting with the prototype. Chapter III provides some background on system implementation and migration issues. It also contains a detailed description of the core applications which were developed for the ISCAS prototype. An analysis of the ISCAS prototype is provided in Chapter IV. The analysis includes an overview of the results, provides a discussion on the various lessons learned, and details recommendations for enhancing the prototype. Finally, conclusions for the thesis research questions listed above are addressed in Chapter V. Several recommendations for further research are also discussed.

II. RESOURCES AND REQUIREMENTS

This chapter describes the work which had already been completed by the ISCAS planning committee before the prototyping effort began. Included is a discussion on the resources required to build and support the Web server for the ISCAS prototype. Additionally, the user and process requirements deemed essential to the prototyping effort are described in detail.

A. BACKGROUND

The ISCAS '98 conference management process was well underway prior to beginning any requirements analysis for developing the on-line collaboration system. The pre-existing work would serve to provide the preliminary requirements used during the initial stages of prototype development. This section provides a background discussion covering the requirements derived from previous work and pre-existing resources.

1. First Call For Papers

A single page flyer distributed by the conference planning committee would become the most important resource used to determine prototype requirements. The ISCAS '98 conference had been originally announced through a distribution of small color posters. In addition to the conference location and schedule, the posters provided a point-of-contact and a temporary World Wide Web (WWW or Web) address. These posters were later followed by a more detailed flyer titled: "1998 IEEE International Symposium on Circuits And Systems: First Call For Papers." This flyer would form the primary content for the ISCAS Web site and would lead to the preliminary requirements specification used in the development of the prototype's initial on-line paper submission application.

The "First Call For Papers" invited prospective authors to submit extended summaries of papers reporting their original work in all areas of circuits and systems research. Paper summaries for regular sessions were required to be submitted to the Technical Program Committee (TPC) for review. There were 54 proposed topics listed in

the flyer; however, papers were not limited to those topics. Figure 1 is a list of the original topics provided in the “First Call For Papers.” Additional proposals for special sessions, plenary sessions and short courses were required to be submitted for review directly to the

1 Analog Circuits and Discrete Systems	6 Digital Signal Processing
1.1 Analog circuits and systems 1.2 Switched capacitor/current techniques 1.3 Amplifiers, oscillators 1.4 Solid state circuits 1.5 Analog and mixed signal processing 1.6 Data conversion and S-D modulation	6.1 Digital filters and filter bank design 6.2 Wavelets, multirate signal processing 6.3 Parameter estimation 6.4 Adaptive signal processing 6.5 Multidimensional systems 6.6 Fast algorithms
2 Circuit Theory and Power Systems	7 Multimedia and Video Technology
2.1 Linear and nonlinear circuits and systems 2.2 Chaos and applications 2.3 Distributed Systems 2.4 Power distribution systems 2.5 Power electronics and systems	7.1 Speech processing and coding 7.2 Image processing and coding 7.3 Video coding & motion compensation 7.4 High definition television 7.5 Multimedia systems
3 VLSI	8 Communication Circuits and Systems
3.1 Analog ICs, digital ICs, and ASICs 3.2 Low voltage/low power ICs 3.3 GaAs and high speed ICs 3.4 Fault tolerant systems 3.5 Testing: analog, digital, and mixed	8.1 Signal processing for communications 8.2 High frequency circuits 8.3 Wireless/mobile communications 8.4 Optical communications 8.5 Underwater communications
4 Computer Aided Design	9 Computer Communication Systems
4.1 Circuit layout 4.2 Modeling and simulation 4.3 Optimization techniques 4.4 Large scale networks 4.5 Circuit modeling for electronic packaging 4.6 New CAD tools	9.1 High speed modems 9.2 Broadband ISDN 9.3 Asynchronous transfer mode 9.4 Speech and video modeling 9.5 Teleconferencing & distance learning 9.6 SONET and optics circuits
5 Neural Systems	10 Applications
5.1 Neural networks 5.2 Cellular neural networks 5.3 Biological computing 5.4 Fuzzy circuits and systems 5.5 Biometrics	10.1 Sensors 10.2 Robotics 10.3 Electromechanical systems 10.4 Dual use technology 10.5 Space systems design

Figure 1. Prospective Regular Session Topics

respective committee chairs. Accepted proposals for all sessions would ultimately require final paper submissions; however, since the regular sessions would comprise the majority of the conference, the initial Web applications would be designed exclusively for the proposed regular session papers. A separate ‘final’ paper submission application would later provide for the submission of all final papers.

The requirements for submitting extended paper summaries were also included in the “First Call For Papers.” These included submission and notification deadlines, required paper summary length, and required cover sheet information. Figure 2 contains a reproduction of the paper submission requirements. There were two methods for submitting the papers. First, a postal address was provided to allow for mailed submissions. Postal submissions would require five hard-copies of the paper summary in addition to an

Authors are invited to submit extended summaries (1000-2000 words) of their papers along with a cover sheet for review by the Technical Program Committee. Submissions can be sent to:

ISCAS98 Technical Program Co-Chairs
c/o Department of Electrical and Computer Engineering
Naval Postgraduate School
Monterey, CA 93943, USA

Submissions are accepted in ONE of the following two formats only (No FAX submissions please):

*PDF/Postscript submissions via WWW at <http://iscas.nps.navy.mil/submit/>

*Five copies of hard-copy submissions by postal mail; please include PDF/PS/DVI file on floppy disk

Submissions should include:

1) A Cover Sheet containing:

- (i) Title of proposed paper, authors' names and affiliations;
- (ii) Postal address, phone and FAX numbers, and e-mail address of the contact author;
- (iii) Paper category number (from the topic list) that best describes the paper; and
- (iv) Choice of presentation (lecture or poster)

2) 1000-2000 word extended summary that includes:

Paper title, authors' names, affiliations, and addresses; and

Paper category number (from the topic list)

Once accepted, authors will be asked to prepare a four-page camera-ready paper for the symposium proceedings.

AUTHORS' SCHEDULE

Deadline for Submission of Summaries

October 1, 1997

Notification of Acceptance

December 15, 1997

Deadline for Submission of Camera-ready paper

January 30, 1998

Figure 2. Extended Summary Submission Requirements

electronic version on floppy disk. Second, a new and permanent WWW address provided access to the formal ISCAS Web site which also contained a file upload application that would allow for electronic paper submissions over the Internet. Electronic submissions would be limited to either Adobe's Portable Document Format (PDF) or Postscript file format as will be discussed further below.

2. Electronic Submission File Formats

The ISCAS planning committee had previously determined that use of the Portable Document Format (PDF) from Adobe Systems Incorporated would be an essential requirement for the ISCAS prototype.

Adobe's PDF lets authors publish electronic documents that preserve the look and feel of documents they create. [Ref. 3]

This meant that electronic versions of final papers in PDF format would look exactly like the original printed versions. In fact, the printed versions for the conference proceedings could be printed directly from PDF files and would still look as if they had been printed from within the original authoring application. This capability would allow for the electronic submission of papers and would eliminate the need for authors to mail paper copies to the ISCAS TPC.

A PDF file viewer application would be required in order to open, view and print the received papers. Adobe provides a free viewer application called Adobe Acrobat Reader. This application is available for free download from many different locations on the Web, including Adobe's own Web site at www.adobe.com. The viewer application is also typically included with the distribution of many software titles, especially the major Web browser applications. The Acrobat Reader application would also be required for and included on the CD version of the conference proceedings.

The Web browser plug-in included with the Acrobat Reader application would be another key piece of software for the prototype. This plug-in allows for the viewing and printing of PDF files over the Internet from directly within a Web browser application. This capability would allow the ISCAS prototype to easily distribute the PDF papers for on-

line review during the review and selection process. Although all reviewers would need the Acrobat Reader application and the browser plug-in to be installed on their computers, use of the software would eliminate the need to copy and mail out papers to each of the over 200 conference paper reviewers.

3. The Initial ISCAS Web Site

A Web site had already been established for the ISCAS conference prior to the commencement of prototype planning and development. The initial ISCAS Web site was installed on an Intel 486 Personal Computer (PC) running the Linux operating system and Apache Web server software. A mail server application ran concurrently with the Web server. The mail server facilitated electronic mail (e-mail) among committee members and provided broadcast capability for mass announcement electronic mailings. The Web site was essentially an electronic version of the "First Call For Papers." It displayed a basic home page with links to a few additional pages. The site advertised the 1998 ISCAS conference and provided links to electronic versions of the information contained in the "First Call For Papers" flyer. The Web site also contained an on-line form which supported the electronic submission of regular session paper summaries; but it did not provide a mechanism for automatically accumulating and organizing paper and author information into a database.

A Common Gateway Interface (CGI) application was being used to enhance the functionality of the ISCAS Web server.

A CGI program provides a powerful capability which greatly expands the role of a Web server to allow for graphical fill-out forms whose information can be sent back to the CGI for further interpretation. [Ref. 4]

The CGI being used was a Perl program language script that had been created to process the existing Web form in order to allow for the electronic submission of papers. Whenever an author used the Web form to submit a paper along with the required contact information, the Web server would pass the incoming data to the CGI for processing. The CGI would then handle the tasks of uploading the paper to the server and e-mailing the information

from the Web form to an administrator. The e-mail message contained contact author and paper information which had to be manually entered into an existing Microsoft Access database by administrative personnel. Any additional information required for the database then had to be pulled from the cover sheet of the uploaded paper and entered into the associated paper record within the Access database. The schema for this pre-existing Access database would provide the preliminary data model which would be used to develop a relational database schema for the advanced CGI applications to be built for the prototype. Prior to completing a fully automated paper submission CGI for the ISCAS prototype, 60 paper summaries were submitted using the initial Web form and CGI configuration.

B. THE ISCAS WEB SERVER

A variety of hardware and software resources would be integrated to develop and support the prototype server. This section discusses the pre-existing and procured server resources which would be essential to the ISCAS prototype. A discussion regarding implementation and migration is saved for Chapter III.

1. Web Server Resources

The Web server for the ISCAS prototype would require a more robust and higher capacity hardware and software configuration than the Intel 486 PC could provide. The ISCAS planning committee had previously determined that a Microsoft Windows NT Server with a large hard disk storage capacity would be used to support the conference. A Dell PowerEdge 2100/200 MHz Pentium Pro server platform running Microsoft Windows NT 4.0 Server operating system would be acquired to provide substantial back end support to the Intel 486 PC. Netscape Communications' Enterprise Server software would then be acquired to provide the necessary Web services on the NT server. The 486 PC would still be needed to provide mail and domain name services.

The addition of Everyware Development Corporation's Tango for Access, a database middle-ware CGI, would provide for direct interaction between the Enterprise Web server and the Access database, thereby allowing for automatic insertion and retrieval

of paper and author information using a standard Web browser. The Tango software consists of two applications, Tango Editor and Tango Server. Tango Editor is used to develop Web applications capable of interacting with an Access database. Tango Server, the actual CGI, extends the capability of a Web server to process the Web applications developed using the editor. Use of the Tango CGI would eliminate the need to have the Perl script CGI e-mail the received Web form data to administrative personnel for manual entry into the Access database; however, the Perl CGI would still be required to perform file uploads. Thus, the existing Perl script would require modification to remove the e-mail feature after porting it over from the 486 PC to the new NT server. Its only remaining functionality would be to upload the paper summaries from the client platforms to the NT server.

2. Support Resources

Adobe's Acrobat Exchange software would be required to support the receipt of papers in Postscript file format. Acrobat Exchange software provides the ability to create, view, edit and print PDF files. Its companion application, Acrobat Distiller, is capable of converting batches of Postscript files into PDF files. The Acrobat Exchange software would normally be required for any author who wanted to submit a paper in PDF format. Rather than forcing all authors to acquire Acrobat Exchange, the TPC would accept submissions of electronic papers in the Postscript file format; however, this would require ISCAS administrative personnel to convert the received Postscript files into PDF files. Further, most standard methods of encoding and compression would be allowed in order to minimize file transmission times. Papers received in any of these various formats would first have to be decompressed and/or decoded before being converted to PDF. Once a paper had been received and converted to PDF, it could then be placed into the Web server's on-line paper directory and made available to the reviewers via the Internet.

Several additional resources would be needed to provide background support for the prototype. An uninterruptible power supply (UPS) would be needed to keep the Web server on-line in order to maintain the reliability and integrity of the system. A tape backup

system based on Seagate's Backup Exec would be used to safeguard the contents of the Web site, the database, and the uploaded papers in the event of a catastrophic disk failure. Two scanners would be needed to scan in any mailed paper summaries which were not accompanied with an electronic version on disk. A Postscript laser printer would be required to print out any problematic files which could not be electronically converted into PDF format. These printouts would then be scanned into electronic PDF format using the Adobe Acrobat Exchange software.

C. PROTOTYPE REQUIREMENTS

This section discusses the user and process requirements which were identified primarily from the "First Call For Papers" and through interaction and discussion with the ISCAS committee members. Since the prototype would actually be used in support of a real-world conference, a build-and-fix prototyping methodology would be used. This approach would result in additional requirements being identified through user feedback gained from interacting with the prototype.

1. User Requirements

User requirements would determine which applications would be required and when they would be needed. Throughout the course of the prototyping effort, five categories of clients, or user groups, would be identified. Each user group would require different access levels and specific types of interaction with the prototype.

a. *Paper Authors*

Authors represented the largest user group (well over 2000). They would require general public access to the prototype in order to submit their papers on-line. They would also require the capability to resubmit their papers in the event of a transmission or other problem during the submission of their original papers. Final paper submissions, including abstracts, would also be required for those authors whose original submissions had been selected for presentation at the conference.

b. Paper Reviewers

Reviewers (over 200) would need to conduct on-line reviews of the papers. This would require access to the PDF papers and to restricted portions of the on-line database for the related paper records. The reviewers would be required to submit on-line review forms for each paper they reviewed. A protected access mechanism would be required to prevent general public access to the on-line PDF papers and to the database. This would also ensure that only designated reviewers could submit on-line reviews.

c. ISCAS Planning Committee

Committee members (approximately 20) would require on-line access to retrieve paper and author information from the database in addition to submission statistics. This information would be needed to respond to queries from authors and to coordinate the selection and assignment of paper reviewers. In addition, the Technical Program Committee (TPC) members would require access to all of the on-line reviews submitted by the paper reviewers. The reviews would be used during an on-line selection process to determine which papers would be accepted for presentation at the conference. After the selection process, the TPC members would require access to an on-line scheduling application in order to assign each of the accepted papers for presentation during one (and only one) of the 180 sessions planned for the three day conference. The sessions also had to be organized and scheduled for the conference; however, this process would prove difficult to constrain in a manner which would allow efficient on-line coordination. Due to time constraints and process complexity, session scheduling would be handled manually during a two day meeting of the TPC.

d. Administrators

Five Administrative personnel would manage all related aspects of receiving, confirming and acknowledging the papers. This would include manual entry of papers received via postal mail, converting all received files into PDF format, validation of the database and all received papers, acknowledging the condition of received papers to the

contact authors, and notification of authors for the accepted papers. Administrators would also require complete access to the database, to include a capability to delete invalid and duplicate records.

e. Developer

The prototype developer would design, build, test and maintain the applications and the underlying database in support of all users. Access would be required to all applications and to the entire database.

2. Process Requirements

Many processes would be identified in support of the user requirements described above. Each of the core processes described below would result in a specific application that was developed for the ISCAS prototype and made available for use over the Internet. A detailed discussion of those core applications will be left for Chapter III.

a. Paper Submission

To support an on-line paper submission process, an application would have to meet a variety of requirements. In addition to accepting extended paper summaries in electronic file format via the Internet, it would have to provide the capability for authors to submit their paper cover sheet data, author data and contact information. The submitted electronic file would have to be renamed using an auto-generated paper tracking number and stored in a protected receiving directory. The cover sheet, author, and contact information would need to be automatically stored in an on-line database using the assigned paper tracking number as an index. Further, a resubmit option would be required to address electronic transmission problems. Administrative personnel would also need to use this application to load papers received by postal mail directly into the on-line system. This prototype application would have to be made available for general public access until the submission deadline had passed.

b. Logging In

A login application would be necessary in order to provide access to the higher level functions required by reviewers, committee members, administrative personnel and the developer. When used to gain access to the system, this application would have to provide a welcome screen that displayed all functions for which a given user had access. This meant that users (other than authors) and applications would have to be assigned individual access levels to support a run-time comparison by this login application. A tutorial provided with the Tango for Access software would be used as the basis for developing the login application. The Tango Tutorial would also be used to guide the creation of user accounts as well as the assignment of user and application access levels.[Ref. 5]

c. Acknowledging Receipt of Papers

An application would be needed to provide administrative personnel the capability to confirm that submitted papers were in good condition and were readable over the Internet by providing on-line links to the papers. The application would also have to support the automatic generation of two separate form letter style e-mail messages. The primary e-mail message would be for notifying contact authors that their submitted papers were received in good condition (acknowledgments). The alternate e-mail message would be for notifying contact authors to inform them of problems with their submissions and to request resubmissions (negative acknowledgments). Both e-mail messages would need to be auto-generated from an appropriate template using the information from the Access database. Each would require the inclusion of all identifying paper and author information. Additionally, the on-line form e-mail application would have to provide a custom editing feature to allow administrative personnel the capability to include specific comments in either of the messages, especially with regard to unreadable submissions. This application would also need to update the Access database to mark a paper record as having been acknowledged (Acked) or negatively acknowledged (NAcked) after transmitting the appropriate e-mail message.

d. Paper Review

To support the review of papers over the Internet, designated reviewers would require access to an application which could provide links to assigned papers for on-line and/or off-line reading. The application would also have to provide a capability for submitting an on-line electronic review form. The review form would need to accept criteria rankings, comments, and an acceptance recommendation (Accept, Not Sure, Reject). The data from the review forms would have to be automatically stored in the database for later use by the TPC during the paper selection process.

e. Paper Selection

The paper selection process would involve comparing and contrasting all reviews submitted for each paper in order to make an accept or reject decision. The TPC members would need an on-line application to support this process by allowing selection of papers for presentation at the conference. The application would require the capability to retrieve, list and sort reviews by paper number. Additionally, it would have to provide a form for making and/or changing the final acceptance decision for each paper. The database would also have to be automatically updated to reflect all final status decisions.

f. Presentation Scheduling

Each of the accepted papers would have to be scheduled for presentation during one of the 180 sessions planned for the three day conference. This would require the TPC to first group all accepted papers by related subtopics to identify the themes for each of the sessions. The complexity involved in this process would require a two day TPC meeting to manually organize the sessions using a large wall as a layout to ensure that sessions with similar themes did not overlap. Once this was completed, an on-line application would be required to allow TPC members to schedule each individual paper into a session with an appropriate theme. The application would have to ensure that each accepted paper could only be scheduled once. It would also have to support removing a paper from one session so that it could be added to another. Further, the application would

need to provide a mechanism for labeling a session with a title, a session chair and a session co-chair.

g. Final Paper Submission

After the selection and scheduling of papers for presentation at the conference, POC authors of accepted papers would require notification to submit a final, camera-ready version of their papers for publishing. Address, paper and author information from the Access database would be used by administrative personnel to prepare formal letters using a word processor. The formal letters would include scheduling information and would direct the authors to submit their final papers on-line. The POC authors would also be notified, via a broadcast e-mailing, to check the ISCAS Web site for a list (by paper tracking number only) of all accepted papers and for a link to a final paper submission application. The address list for this e-mail message would be generated from the database. Most importantly, an on-line submission process, nearly identical to the extended summary submission process described above, would be required to support the submission of final papers. Some changes would be necessary, including the additional requirement to have authors include an abstract for their papers. The application designed to meet the final paper submission requirements would take into account any lessons learned from the original submission application. It would also need to be linked to a new Access database from which the entered information could ultimately be published.

h. Miscellaneous Support

In addition to the core process requirements above, several support applications would be required to address needs specific to managing the prototype. Most of these applications would be specialized queries and single purpose utilities designed in response to individual requests from committee members and administrative personnel. Further, some special purpose applications were only required as a result of the migration from the original submission application located on the initial Web server. These applications would not have been required had the prototype been on-line from the very

beginning of the paper submission process. The following is a list of the more prominent support application requirements:

- An application would be required to provide a means for transferring the 60 papers received using the original Perl Script CGI from the 486 PC over to the newer NT server. This application would allow administrative personnel to transfer the papers and enter the appropriate information into the database using the previously assigned paper tracking numbers. The first 60 tracking numbers for the new submission application would have to be reserved for this purpose.
- Since approximately fifty reviewers submitted papers for the conference, a special utility would be required to allow the TPC chair to tag their paper records and identify them as belonging to paper reviewers. This would prevent paper reviewers from being able to access their own records to recommend final acceptance.
- Several browser applications would be needed to support different database query capabilities. Administrative personnel and committee members would require paper access by paper number, by paper title and by author to respond to author trouble calls. These browser applications would also be used to locate duplicate records and to check for existing records prior to entering submissions received by postal mail.
- Also, various queries would be requested by committee members to generate one-time listings of records meeting certain criteria. Examples of particular requests include requirements for: a list of POC author e-mail addresses, a list of papers pending review, a list of papers pending scheduling, a preliminary conference schedule, and a list of accepted papers. On-line applications to support these types of queries could generally be completed in a matter of minutes.

i. Other

One of the early goals for the ISCAS prototype was to provide an on-line registration capability which would be integrated with the database to automate the registration process. This would have greatly simplified the coordination required with the publishing efforts to ensure that authors of published papers had in fact registered and paid for the conference. Due to time constraints and security concerns, an application for this process would not be included in the prototype's application suite; however, the on-line

registration capability would be provided via an outsourcing agreement with a commercial provider.

III. THE ISCAS PROTOTYPE

The ISCAS prototype is currently being used at the Naval Postgraduate School as a working prototype for coordinating and managing the IEEE's 1998 International Symposium on Circuits and Systems (ISCAS '98). As stated previously, the objective of the prototype was to pipeline, into a single on-line system, all of the traditional conference organization processes. As a result, a variety of conference functions were converted into browser-based applications and made available over the Internet in order to provide a world-wide collaboration environment for the widely dispersed members of the committee and all other conference participants. Of particular concern, were those functions related to receiving, processing, acknowledging, distributing, reviewing, accepting and scheduling papers that were submitted for conference presentation. Final paper submission, conference registration and publishing functions were also targeted for prototype inclusion.

This chapter begins by describing the migration from the pre-existing server to the new server which provided the foundation for the ISCAS prototype. Each of the core applications developed during the prototyping effort are then described in detail.

A. SERVER MIGRATION

Prior to deploying an initial production version of the ISCAS prototype, Web services had to be migrated from the 486 PC to the new server. This started with the development of a new Web site for the NT server. Information was pulled from the "First Call For Papers" flyer and from the initial Web site located on the 486 PC. Page design, HTML coding and site publishing were completed using GoLive CyberStudio Web design software on an Apple Macintosh PowerBook 5300 running Apple's MacOS 8.0 operating system. The published site was then loaded onto the NT server. To maintain mail services on the 486 PC and to avoid changing the well-advertised domain name (www.iscas.nps.navy.mil) for the original Web site, the new site's home page was also loaded onto the 486 PC in place of the pre-existing Web site. The new home page

contained an HTML frame set with links to the remainder of the new Web site and its full structure, all of which resided solely on the new NT server. At this point, HTML pages from the Web site were being served from the NT server while the 486 PC continued to handle the paper uploads. This setup allowed for a distribution of server resources between the old and new servers while providing for a smooth testing and migration path to the eventual prototype on the NT server. The only visible difference to clients browsing the Web site was the new design and layout of the Web pages. All potential confusion with Web addressing and new Web site announcements had been avoided.

Before development could begin on the Web applications, a database back-end for the ISCAS conference was prepared and loaded onto the NT server. The original Microsoft Access database was used along with the "First Call For Papers" flyer to identify which data would be required to support the Web applications. A new relational database schema was then developed to provide greater flexibility in application development and to minimize the limitations and data redundancy problems typically associated with the mostly flat-file format of the existing Access database [Ref. 6]. The Tango Editor application was then used to link to the newly created Access database in order to begin development on the first Web application.

The new extended summary submission application (discussed below) was the first Web application completed and linked to the new ISCAS Web site. It represented the final step in migrating to the NT server. The modified NT Perl script was used in conjunction with this new submission application (via the Tango Server CGI) to upload the papers to the NT server. Communications between the Perl script CGI and the Tango Server CGI were conducted through a combination of HTTP redirect statements and environment variable exchanges. This allowed the two CGIs to pass data for uploading the papers and to coordinate database updates after a successful upload without requiring additional interaction by the clients. With the exception of electronic mail services, all server activity was then being handled by the NT server. The final modification required on the 486 PC was to set a server redirect for any clients to be automatically and unknowingly transferred

to the NT server when using the ISCAS Web address. No further system configuration changes were required. From this point on, additional applications were developed, tested and linked to the Web site on a priority basis in order to meet the necessary user requirements for interacting with the ISCAS prototype.

B. PROTOTYPE PHASES

The various conference functions could be separated into four distinct phases for the overall prototyping effort. The first phase was called the Initial Submission Phase. This phase included the creation and distribution of the First Call For Papers, the submission of extended summaries for committee review, and the acknowledgment of received submissions. Next was the Selection Phase, which included the distribution of extended summaries to reviewers, the collection of review forms, the selection of conference papers, and the scheduling of selected papers for conference presentation. Then came the Final Submission Phase, which included the notification of accepted and rejected authors, the submission of final (camera-ready) papers, and the acknowledgment of received papers. The fourth and final phase would be called the Publishing Phase and would include conference registration and publishing of the conference proceedings.

1. The Initial Submission Phase

a. *Background*

In a traditional conference, a First Call For Papers would be distributed to signal the start of the Initial Submission Phase. Prospective authors would then submit their proposed papers for review by mailing them to the conference organizing committee at the host institution. Five or more copies of each paper would be received, verified, recorded, sorted, and filed for distribution to reviewers by administrative personnel. This would include manual data entry into a conference database and assignment of individual paper tracking numbers. After receiving the prospective papers, a formal acknowledgment would be mailed to all POC (point-of-contact) authors to confirm the receipt and condition of each

paper. In recent years, limited forms of electronic submission, including the use of e-mail and FTP (File Transfer Protocol), were allowed; but the administrative personnel still had to perform all of the associated functions for this phase. The SPAA '98 conference is a good example of a conference using e-mail to support the electronic submission of papers. Their Web site is located at "<http://sigact.csci.unt.edu/~spaa98/SPAA98.html#email>". [Ref. 2]

The ISCAS prototyping effort proved to be extremely successful in fulfilling the functional requirements of the various processes involved in the initial submission phase. Development of the prototype allowed for full automation of all functions during this phase except for the verification and acknowledgment of the received papers. No copying, sorting, filing, or data entry would be required for the papers submitted via the web. The entire phase was designed to be completely paper-less. Administrative personnel would only be responsible for decompressing and converting non-PDF files into PDF format, moving all received papers (PDF files) from the receiving directory into a designated on-line directory, and acknowledging the papers via e-mail by using an on-line form letter. Everything could be done remotely, via the Internet, using standard web-browser software except for the file conversions and the file transfers between directories. These activities required physical access to the server. (Note: Advanced scripting capabilities are available which could also fully automate the file decompression, file conversion and file transfer requirements; however, none were incorporated into this initial prototype.)

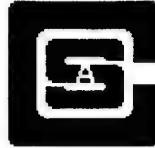
b. The Paper Submission Application

The ISCAS '98 First Call For Papers (discussed in the previous chapter) was distributed to prospective authors and appropriate institutions through the use of mailing lists which are routinely maintained by IEEE. Prospective authors were directed to the ISCAS '98 home page on the web for the on-line electronic submission capability. Figure 3 displays a recent copy of the home page. During the Initial Submission Phase, a "Submit" link was provided in the left hand menu under "Papers". Clicking on the link with a mouse would bring up a new page (Figure 4) with some general submission guidance and a button

titled "Submit a Paper". Pressing the button would start the "Paper Submission Application."

The form displayed in Figure 5 would be displayed in an author's browser to start the paper submission process. This form collects the POC Author and paper information, which will be automatically stored in the Microsoft Access database by the Tango CGI when the "Submit Paper Information" button is pressed. After storing the information, the CGI sends the form displayed in Figure 6 back to the client's browser. This form appears with the "Last Name" and "Email Address" fields already filled in with the POC author information. It collects additional personal information for the author which will be stored in the database after pressing the "Submit Author Information" button. If "Is there another author?" has "Yes" selected and the bottom two fields (Last Name and Email Address) are filled in, then the form will reappear to repeat the process for each additional author. If "Is there another author?" has "No" selected, then the "Paper Submission Form", shown in Figure 7, will be displayed to allow electronic submission (upload) of the paper.

The "Paper Submission Form" actually serves as the interface to the paper upload CGI. This form contains a "Tracking Number" which has been automatically assigned to the paper by the Tango CGI. The author will need this number for any future correspondence and for resubmission of the paper if necessary. After pressing the "Browse..." button to select the appropriate file, the author can start the upload process by clicking on the "Press Here" button. The NT Perl CGI then receives the incoming file, renames it using its assigned tracking number, and stores it in a designated



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Click 'Submit Final Papers' in the Menu (or use the Above Link).

Figure 3. Home Page for ISCAS '98 Web Site

ISCAS '98 Paper Submission

- Please be sure your proposed paper's cover sheet contains: title, authors' names, and affiliations plus postal address, telephone, FAX and e-mail of the contact author.
- Your file should only be in PDF or Postscript format.
- Postscript files larger than 350KB should be compressed using gzip, UNIX compress, or pkzip. Please include a note indicating the type of compression you used in this case.
- Please be patient. Depending on your connection, it can take up to 15 minutes to complete the actual file transfer.
- If you successfully upload your paper, you will see a new page with a serial number. Please use this serial number when referring to your paper in future correspondence.
- The organizing committee can not be responsible for submissions that do not follow the above guidelines.

[Submit a Paper](#)

Figure 4. General Guidance Web Page for ISCAS '98 Paper Submission

Primary Author or Contact Author Identification

Last Name (only) _____ eMail Address _____

Is this a Resubmission? No Yes: Paper Serial Number: _____

Topic: _____ SubTopic: _____

Title: _____

Choice of Presentation Mode: Lecture Poster

Additional Comments

Submit Paper Information Clear Form

The form consists of several input fields and buttons. At the top is a section for author identification with fields for 'Last Name (only)' and 'eMail Address'. Below that is a question about resubmission with radio buttons for 'No' and 'Yes' (with a field for 'Paper Serial Number'). There are dropdown menus for 'Topic' and 'SubTopic'. A 'Title' field follows. Under 'Choice of Presentation Mode', there are radio buttons for 'Lecture' (which is checked) and 'Poster'. At the bottom is a large text area for 'Additional Comments' with scroll bars. Finally, there are 'Submit Paper Information' and 'Clear Form' buttons at the very bottom.

Figure 5. Initial Paper Submission Application - POC Author / Paper Information Form

receiving directory. The Perl CGI then informs the Tango CGI that a paper has been successfully uploaded to the server by sending the received paper's tracking number. The Tango CGI updates the database to indicate that the paper was received and then sends a successful upload message to the client's browser which indicates that the paper submission process has been completed. The message also displays all of the associated paper and author information from the Access database which was submitted using the forms in Figures 5 and 6. The flow chart in Figure 8 provides a graphical overview of the initial submission application.

<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="checkbox"/> IEEE Member?		
eMail Address: <input type="text"/>						
<input type="text"/>	<input type="text"/>	<input type="text"/>	Home Phone Number	Work Phone Number	FAX Number	
<input type="text"/>			School/Company / Affiliation	<input type="text"/> Office Code		
<input type="text"/>		<input type="text"/>	Department	<input type="text"/> Street / P.O.Box		
<input type="text"/>	<input type="text"/>	<input type="text"/>	City	State / Province	Mail / Zip Code	Country
Additional Authors: Is there another author? <input type="radio"/> Yes <input checked="" type="radio"/> No						
<input type="text"/>		<input type="text"/>	Last Name (only)	<input type="text"/> eMail Address		
<input type="button" value="Submit Author Information"/>				<input type="button" value="Restore Original Values"/>		

Figure 6. Initial Paper Submission Application - Author Personal Information Form

Paper Submission Form

Please complete the paper submission process as described below.

First, press the "Browse..." button to select the "postscript" or "pdf" file containing a summary of the paper to be submitted. (You may have to pull down the "Files of type:" menu to select your file)
Note: If you are using Internet Explorer, this may not work properly. If this is the case, please find a copy of Netscape Navigator to use for this upload.

File to upload: Browse...

Next, to upload the file!
(This could take several minutes depending on connection speed and file size.)

Finally, this paper has been assigned a tracking number as follows:

Tracking Number: 1909

Please write this number down for future reference. Should you have problems submitting your paper, you will need this number along with the last name and email address of one of the authors just entered in order to attempt a resubmission. Always use this number when referencing your paper.

Figure 7. Initial / Final Paper Submission Application - Paper Submission Form

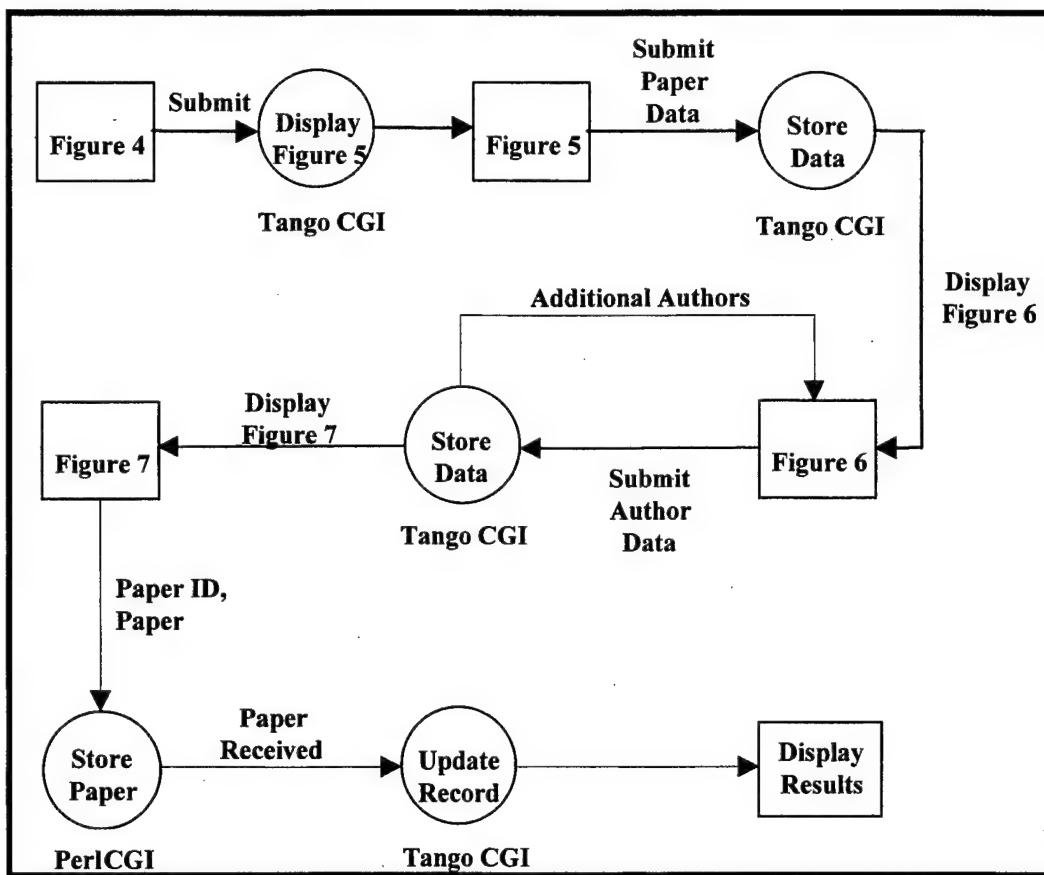


Figure 8. Initial Submission Application Flow

In order to resubmit a paper, an author would start with the form in Figure 5. By entering the POC author's "Last Name" and "Email Address", and by selecting "Yes" for the question "Is this a resubmission?" and including the assigned "Paper Serial Number", a paper could be resubmitted (uploaded again). The resubmission would use the same paper number and would be named with an "r" appended to the paper number. This particular approach turned out to be somewhat dysfunctional and will be discussed further in the next chapter.

When the deadline for submitting papers is reached, the security level of the paper submission application must be increased to prevent any further general public

access. At this point, only administrative personnel with login access will be able to work with the submission application. This will eliminate problems associated with late submissions by simply disallowing them. The capability to completely automate this deadline action exists, although it was not integrated into the ISCAS '98 submission application.

c. The Login Application

The paper submission application is the only application which was made publicly available over the Internet. This was essential in order to allow all potential authors the opportunity to submit papers for consideration. The remainder of the prototype's applications, however, would require login protection in order to prevent unauthorized access. Each of the remaining applications were assigned a security level which corresponded to the access level of those who could use it. Users with login access were assigned an access level which determined which applications they could use. The login application was originally available from the left hand menu section of the ISCAS '98 home page shown in Figure 3. The link was removed after the Selection Phase was completed and is not shown in the figure. Clicking on the link would start the login process by displaying the form shown in Figure 9.

Please Log In

Enter your User Name and Password to gain access to the system.

User Name:

Password:

[Forgot Password?](#)

Figure 9. Login Application - Access Form

A successful login will result in a welcome screen as shown in Figure 10 which will list only those applications for which a user has access. The login application cannot be bypassed by simply bookmarking applications in the browser. This is because

each application validates the access level of the user when started. A user's access level is stored on their machine in a browser "cookie" when they use the login application. Existing cookies cannot be saved for future use because they will expire if there is no interaction with the ISCAS prototype for more than 15 minutes.

d. The Acknowledgment Application

The paper submissions require validation to ensure that they have been received in good condition (non-corrupted) and that they have been converted into PDF files. On-line readability of the electronic papers is the primary concern (not content). After a received paper has been decompressed, converted into PDF, and moved into the designated on-line directory, it can be confirmed and acknowledged by sending an e-mail message to the POC author. Validation is conducted by administrative personnel with login access to the acknowledgment application. When the acknowledgment application is selected from the welcome screen in Figure 10 (link to application is not listed in the sample shown), the browser displays a listing of papers which need to be acknowledged. A sample listing is shown in Figure 11. There is a button (which is not shown) at the bottom of the paper listing which will display the next 100 submitted papers when pressed. A paper can be confirmed by clicking on its listed title which will open the paper in the browser using Adobe Acrobat Reader and its associated web browser plug-in.

After confirming the condition of the paper (by reading it), a confirmation form can be opened by clicking on the desired paper's number in the "Paper" column. Figure 12 displays a sample confirmation form which opens up with the paper and author information already filled in along with the message to be sent to the POC author. The sample shown is the form for confirming receipt of a paper in good condition. Beneath this form in the browser window is another form (not shown) which allows for notification that a failed transmission or other problem has occurred which will require the POC author to resubmit the paper. The message can be edited in either form to provide more detailed information if needed. Pressing the "Send Confirmation" button will send an e-mail with

Welcome, Jim Webmaster!

Last login: 01/16/1998 19:33:22

Paper Reviews

- [Review a Paper](#)
- [Locate Paper Reviews For Final Status Selection](#)

Paper Browsing & Scheduling

- [List all papers which have been accepted](#)
- [List all papers which are pending a final decision](#)
- [Detailed Paper Browser](#)
- [Schedule Papers into Sessions](#)
- [Display / Update Session Header Information \(All Sessions\)](#)
- [View Complete Schedule \(All Sessions\)](#)

Database Administration

- [Submit a Paper](#)
- [Browse Paper Records](#)
- [Detailed Paper Browser](#)
- [View/Edit Persons/Database Users](#)
- [Locate Paper Reviews by Paper Number](#)
- [Mark Papers for "Special" Review](#)

Figure 10. Login Application - Welcome Screen / Application Menu

Confirm Paper, Then Send Acknowledgement

Click on Title to Confirm (View) Paper.

Click on Paper Number to Acknowledge Paper.

Use Caution: Click on the Topic to edit the paper record.

There are 150 matching records. Displaying matches 1 through 100.

Paper	Name, eMail	Topic	Title
1804	Abel, none	1.12	Statistical Analysis of Chaotic Communication Schemes
1887	Afghahi, cafghahi@sedona.intel.com	1.12	Novel Methods to Test CMOS Sensor Chips
1885	Afghahi, cafghahi@sedona.intel.com	1.12	HDL Modeling of a CMOS Sensor Chip
1888	Afghahi, cafghahi@sedona.intel.com	1.12	A Novel Incremental A/d for Digital CMOS Sensor Chips

Figure 11. Acknowledgment Application - Sample List of Paper Submissions

ISCAS 98 Paper Confirmation Form

The following form confirms that ISCAS 98 has a readable electronic version of the paper.
You may modify the message, if desired.

Acknowledgement of Paper Submission for ISCAS98

Paper Number: 1804

Paper Topic: 1.12

Title: Statistical Analysis of Chaotic Communication Schemes

Authors: Abel, Schwarz, Goetz,

The above referenced paper has been received in good condition by the
ISCAS98 Secretariate. Your submission will now be sent for review. You
will be notified of the outcome of the review around December 15, 1997.
This year the author's kit will be sent to you in electronic form. The
list of accepted papers will also be posted on the symposium website.
Please reference the above paper number in any future correspondence.

Thanks for submitting your work to ISCAS98.

Send Confirmation

Reset Confirmation

Watch the bottom of your screen after pressing "Send Confirmation".
Wait for the "Done" message, then press this button:

Ack Paper Record

Figure 12. Acknowledgment Application - Paper Confirmation Form

the message to the POC author. After sending the message, pressing the "Ack Paper Record" button will tag the paper record in the database as having been acknowledged and will return the user to the listing in Figure 11, which will no longer have an entry for the paper just acknowledged. In the form not shown, the buttons are titled "Send Negative Acknowledgment" and "Nack Paper Record" respectively. They work the same, except the database record is tagged to indicate that the paper has not yet been received in good condition.

2. The Selection Phase

a. *Background*

This phase starts immediately after the deadline for paper submissions has passed. Using traditional methods, copies of the papers would be mailed out to the various reviewers for an acceptance recommendation. This would require anywhere from three to five mailings per paper. Included with each copy would be a review form to allow the assigned reviewer to evaluate the paper and to make an acceptance recommendation to the Technical Program Committee. Each reviewer would read the paper and fill out the attached form. The completed review forms would then be mailed back to the TPC. The TPC would consider all reviews submitted for each paper in order to make a final acceptance determination. The accepted papers would then be arranged by subtopics into related groups. Borderline (maybe) papers would be used to fill up any groups with empty positions. The groups of accepted papers would then be scheduled into presentation sessions for the upcoming conference.

Electronic distribution of papers has previously been attempted using an FTP server at other conferences; however, this method requires the reviewers to locate and transfer the papers to their machines and then to print them out for review. Also, FTP servers do not provide any automated tracking or management services, but they are subject to the same networking issues as a Web server. Submission of review forms has also been allowed via e-mail, but this requires manual sorting for analysis by the TPC. An example

of an FTP server with e-mail review forms is that used by the IEEE INFOCOM '98 Conference on Computer Communications.[Ref. 1]

With regard to the ISCAS conference, the functional requirements of the selection phase were readily adapted to the on-line prototype. The processes for distributing papers and collecting review forms were completely automated on-line and required no postal mailings. Both the TPC paper selections and the scheduling of presentations were also automated on-line. However, grouping the accepted papers by topic and session prior to scheduling proved too complex for an automated application due to the difficulty in constraining the process. There were over 900 accepted papers with more than 50 topics and 180 sessions to deal with. The TPC held a two-day meeting to resolve this manually. All other selection phase functions could be performed using a standard web browser over the Internet.

b. *The Paper Review Application*

After all of the papers have been received and acknowledged, the TPC selects the paper reviewers and assigns a list of paper numbers to each reviewer. There were over 200 reviewers for ISCAS '98. Each reviewer was assigned multiple papers to review; and each paper was assigned to be reviewed by at least two reviewers. Well over 2000 reviews were expected for the 1200 plus papers to be reviewed. A special multi-user login account was created for use by all paper reviewers which would give each of them access to the on-line review application. The account information was distributed by e-mail to the reviewers via the TPC along with their assigned paper numbers. A reviewer could then use the login application from Figure 9 to gain access to the paper review application. Clicking on the link titled "Review a Paper" near the top of the welcome screen (shown in Figure 10) would launch the paper review application. Figure 13 displays the form used to find a paper for review. After a reviewer entered an assigned paper number and pressed the "Find Paper" button, the review form would be displayed in the browser for that paper. The review form is shown in three parts: Figure 14, Figure 15 and Figure 16.

ISCAS 98 Paper Review

Enter the number of the paper to be reviewed.

Paper Number:

Find Paper

Figure 13. Paper Review Application - Access Form

ISCAS 98 Paper Review

Click on the paper's title to view the paper.

Note: You must have Adobe Acrobat Reader installed on your computer.
If you also have the Acrobat Reader browser plugin installed, you can view the paper with your browser.
Some fonts are difficult to read on screen - you can use the magnifying glass or print the paper.
Important: you must use your browser's "Back" button/menu item to return to this form after reading the paper.

Paper Number: 102
Topic: 6. Digital Signal Processing
Sub Topic: 6.2 Wavelets, multirate signal processing
Presentation Mode: Poster
Title of Paper: Optimal Design of Interpolating Wavelet Transform
Comments:

Click on "Author's Name" to email that author.

Author's Name	Primary?	Affiliation	Country
Dr. Peng-Lang Shui	Yes	XiDian university	P.R.China
Prof. Zheng Bao	No	XiDian university	P.R.China
Prof. LiCheng Jiao	No	Xidian University	P.R.China

Figure 14. Paper Review Application - Top of Review Form: Paper and Author Information

A. Evaluation of the paper:

	Excellent	Good	Fair	Poor
1. Originality (novelty) of the work reported:	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
2. Significance of the topic addressed by the paper:	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
3. Clarity of presentation / readability of the paper:	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
4. Technical correctness of the work reported:	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
5. Interest and relevance to ISCAS audience:	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
6. Reference to previous work in the literature:	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
7. Adequacy of the page length of the summary:	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
8. Overall quality of the paper:	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
9. Summary recommendation:	<input type="text"/>			

B. If you reviewed N papers, please rank this paper as n of N.Relative ranking of the paper: out of papers**C. (Optional) If the paper does not fit in the subtopic as currently categorized, please suggest a more appropriate subtopic:**Subtopic: **Figure 15. Paper Review Application - Middle of Review Form: Criteria and Ranking**

D. (Optional) Please write here any comments you may have for the author:

E. (Optional) Confidential comments to the TPC (Comments below will be withheld from the authors):

F. Reviewer Data:

Reviewer's Name:

Reviewer's Affiliation:

Save **Reset Values**

The figure shows a screenshot of a web-based application for reviewing papers. At the top, there is a large redacted area. Below it, section D asks for comments to the author, and section E asks for confidential comments to the Technical Program Committee (TPC). Both sections have large text input fields with scroll bars. Section F, titled 'Reviewer Data', contains two text input fields for 'Reviewer's Name' and 'Reviewer's Affiliation'. At the bottom of this section are two buttons: 'Save' and 'Reset Values'.

Figure 16. Paper Review Application - Bottom of Review Form: Comments / Reviewer ID

The top of the review form, Figure 14, displays the instructions, the paper information from the database, and a list of the authors. Most importantly, the paper title is a link to the actual on-line version of the paper. The reviewer can click the link to either open the paper in the browser or to download the paper for off-line reading. After reading the paper, the reviewer can come back to the review form to complete the evaluation fields shown in Figures 15 and 16. The "Recommendation" field contains a drop-down menu which has three options: "Accept", "Not Sure", and "Reject". Pressing the "Save" button submits the review form, which is then stored in the Microsoft Access database. The reviewer is then automatically returned to Figure 13 to allow review of another paper. Once a review is submitted, it is not accessible by the reviewer or anyone other than a TPC member. Submitted reviews cannot be modified by anyone. If a reviewer wishes to change the evaluation of a paper from a previous review, a new review form can be submitted. The TPC member who makes the final decision will be able to see that both reviews came from the same reviewer and can go with the information from the latest review.

c. The Paper Selection Application

All previously submitted reviews are only accessible via the paper selection application which also requires login access. Only TPC members have access to this application, which has a higher security level than the paper review application. Before this application was made available to the TPC, approximately 50 paper records had to be tagged for "special" access to prevent TPC members from being able to access the reviews of their own papers or those of their assigned reviewers. This was required since over 50 of the reviewers and TPC members had also submitted papers for the conference. These papers could only be approved or rejected by the TPC Chair, although assigned reviewers could still review them.

Clicking on the link titled "Locate Paper Reviews For Final Status Selection" shown in Figure 10 would launch the paper selection application and bring up the search form shown in Figure 17, which contained two drop-down menus for locating the reviews. The "SubTopic" menu allowed for selection of reviews by any or all of the

Use this form to locate all reviews for all papers in a desired SubTopic which meet the selected Final Status.

Locate Reviews by SubTopic:

and Final Status:

Figure 17. Paper Selection Application - Review Search Form

subtopics originally listed in the “First Call For Papers”. The “Final Status” menu allowed for selection based on whether a paper had been “Accepted”, “Rejected”, or was still “Pending”. Additional options were available in the “Final Status” menu for the TPC Chair, which would allow access to the “special” papers. Pressing the “Find” button would bring up a list of the submitted reviews having the desired subtopic and final status.

Figure 18 provides a sample listing of paper reviews located by the paper selection application. The detailed review information is accessible by clicking on a review’s “Date Submitted” which would bring up the form shown in Figure 19. A final selection decision for the paper, or “Final Review Status”, could be made from this form by using the drop-down menu provided and then pressing the “Save Final Status” button. This would return the TPC member to the review listing in Figure 18, which would no longer have any reviews listed for that paper.

Near the end of the paper selection process, the TPC members held a two-day meeting to group the accepted papers into related sessions. One of the goals for the meeting was to identify sessions which were not quite full in order to fill them with papers that had been marked as “Not Sure” by reviewers. There were 180 sessions to cover the three day period of the conference. The TPC members broke the papers down by subtopic and then by session. New subtopics were added to accommodate papers which did not fit well within any of the existing subtopics. This process involved manually laying out the sessions by placing yellow “Post-it” notes across an entire wall to ensure that no related

Click on the Date Submitted to view all of the details for the listed paper review. The detailed listing contains a simple form for Changing the Final Status.

There are 17 matching reviews

Review Criteria

- a. Originality (novelty) of the work reported
- b. Significance of the topic addressed by the paper
- c. Technical correctness of the work reported
- d. Clarity of presentation / readability of the paper
- e. Interest and relevance to ISCAS audience
- f. Reference to previous work in the literature
- g. Adequacy of the page length of the summary
- h. Overall quality of the paper

Criteria Ratings

- 1. Excellent
- 2. Good
- 3. Fair
- 4. Poor

Paper	Final Status	Review Criteria								Reviewer Opinion	Rank	Date Submitted	Reviewer	Affiliation
		a	b	c	d	e	f	g	h					
78	Accepted	2	2	2	1	1	2	2	2	Accept	3 of 20	11/20/1997 09:07:31	Xiaoping Yun	Naval Postgraduate School
78	Accepted	2	1	2	2	1	3	2	2	Accept	1 of 1	11/12/1997 22:25:18	Yoshio Yamamoto	Ibaraki University

Figure 18. Paper Selection Application - Summary of Paper Reviews

A final decision on this paper can be made by choosing and saving the Final Status below.

Paper:	78
Topic:	10.1
Paper Title:	A CMOS Integrated Infrared Radiation Detector for Flame Monitoring
Reviewer & Affiliation:	Xiaoping Yun, Naval Postgraduate School
Date of Review:	11/20/1997 09:07:31
Originality (novelty) of the work reported:	2
Significance of the topic addressed by the paper:	2
Technical correctness of the work reported:	2
Clarity of presentation / readability of the paper:	1
Interest and relevance to ISCAS audience:	1
Reference to previous work in the literature:	2
Adequacy of the page length of the summary:	2
Overall quality of the paper:	2
Criteria Ratings	
1. Excellent	
2. Good	
3. Fair	
4. Poor	
Recommended New Subtopic:	
Comments to Author:	It is suggested that the authors present more details on experimental setup and test procedures.
Confidential Comments:	
Relative ranking of the paper:	3 of 20
Reviewer's Recommendation:	Accept
Choose Final Review Status:	<input type="button" value="Accepted"/> ▼
<input type="button" value="Save Final Status"/>	

Figure 19. Paper Selection Application - Detailed Review / Final Status Selection Form

sessions would be scheduled simultaneously. At the end of this meeting, a final decision had been made for all submitted papers and the accepted papers were ready to be scheduled and sequenced into a presentation order within the identified sessions.

d. The Presentation Scheduling Application

Each of the conference sessions was available via the presentation scheduling application, which was also only available to the TPC members. The application would launch by clicking on the link titled “Schedule Papers into Sessions” shown in Figure 10. It started with the form shown in Figure 20. The three drop-down

Day	AM/PM	Session Number
Session: Monday	Morning A	1

Display Session

Figure 20. Paper Scheduling Application - Session Access Form

menus shown could be used to select a particular session in which to schedule papers for presentation. Pressing the “Display Session” button would bring up a form like the sample shown in Figure 21. If the “Session Title”, “Session Type”, “Chair”, and “Co-Chair” fields were not already filled in, a simple form (not shown) for labeling the session would appear first. Papers already scheduled into the session would be listed in order of presentation as shown. Papers could be added by simply entering a “Paper Number” and the desired “Order” of presentation and then pressing the “Add Paper” button. The rest of the information shown for a paper would be automatically extracted from the database and the list of papers would be updated and sorted. Attempting to add a paper which had already been scheduled in this session or any other session would generate an error message to notify the user that the paper could not be added without first removing it from its other scheduled session. Clicking on a paper’s “Title” would bring up the form shown in Figure

22, which allowed for removing the paper from the session or changing its presentation order. Pressing either of the two buttons on the form would make the desired changes and return the user to the form in Figure 21 to display the updated list of presentations for the session. After all the papers had been scheduled, the Microsoft Access Database could be queried to automatically generate the ISCAS conference schedule.

**Click on a paper title to allow removal or to change the paper's presentation "Order".
The presentation "Mode" is the first choice listed by the author.**

Session Title: Parameter Estimation

Session Type: Lecture

Chair: Professor Eugene I. Plotkin, Concordia university, Canada

Co-Chair:

Session: Monday Morning A Session 1

Order	Primary Author	Title	Paper	Topic	Status
1	Stylianou, Ioannis	On the Harmonic Analysis of Speech	584	6.3	Accepted
2	Plotkin, Eugene	Parameter-free structure modeling: A Contribution to the solution of highly correlated AR-signals	1510	6.3	*Accepted
3	Ching Pak Chung	A new approach for coherent direction-of-arrival estimation	1310	6.3	Accepted
4	Siu, Wan-Chi	Non-minimum phase FIR System Identification using Cumulants with Selected Orders	1626	6.3	Accepted
5	Choi, Jinho	A subspace method for blind single channel identification using redundancy transform in transmitters	1385	6.3	Accepted
6	Zheng, Wei Xing	On Implementation of a Least-Squares Based Algorithm for Noisy Autoregressive Signals	395	6.3	Accepted
7	Feng, Gang	Parallel Computation of SVD for High Resolution DOA Estimation	312	6.3	Accepted
8	Yu, Hongyi	Performance Analysis of a class of Cyclic Weighted Subspace Fitting Method of Direction Estimation for Cyclostationary Signals	172	6.3	Accepted

Add a paper to this session:

Paper Number: **Order:** **Add Paper**

Figure 21. Paper Scheduling Application - Session Scheduling Form

Use this form to change the order in which this paper is presented during the session or to remove this paper from the session.

Day: Monday
AM/PM: Morning A
Session: 1
Presentation Order:
Paper Number: 584
Topic: 6.3
Status: Accepted
Presentation Mode: Lecture
Paper Title: On the Harmonic Analysis of Speech

Change Presentation Order

Remove from this Session

Figure 22. Paper Scheduling Application - Change Form

3. The Final Submission Phase

a. *Background*

This phase is very similar to the initial submission phase. The primary difference is that instead of mass distributing a "First Call For Papers", the authors who submitted papers will be notified as to whether their papers have been accepted or rejected. This requires administrative personnel to mail out formal letters of notification to each POC author. Those authors with accepted papers are directed to submit final, camera-ready versions of their papers for publishing. The submission and acknowledgment functions are essentially identical to those in the initial submission phase.

For the ISCAS prototype, a very simple query application was created to pull and format paper and author information from the database to be merged with a formal notification letter in a word processor. There were two different letters, one for accepted papers and one for rejected papers. A temporary employee was hired to manually merge

and mail all of the letters. With regard to the submission and acknowledgment functions, a new suite of applications was developed using a new database. Many lessons learned from the initial submission phase were incorporated into the new applications in an attempt to minimize or eliminate most of the problems experienced with the use of the original applications. The specific problems and lessons learned will be discussed in detail throughout the next chapter. The acknowledgment application remained relatively unchanged, but the paper submission application was completely overhauled.

b. The Final Paper Submission Application

The link from Figure 3, titled "Click Here to Submit Final Papers!", displays the new application links shown in Figure 23. There is a link for accessing the login application and two other links which now more clearly differentiate between the submission and resubmission aspects of the process. Clicking the "Submit a Final Paper" link brings up the form shown in two parts, Figures 24 and 25. The first thing asked for in

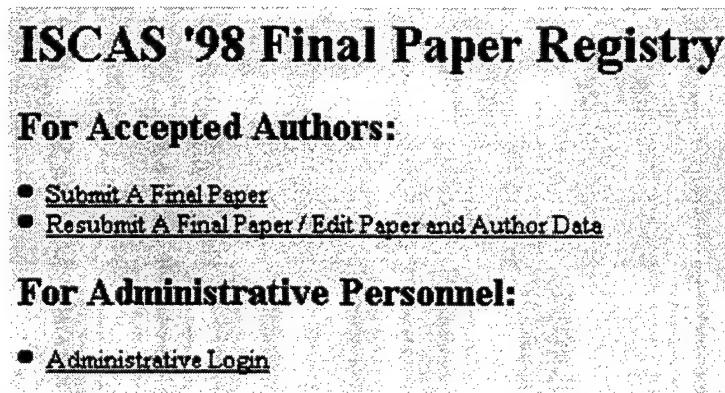


Figure 23. Final Paper Submission Application - Access Page

Figure 24 is the previously "Assigned Paper Tracking Number" which is required to later verify a paper submission as an accepted paper. The author information is being requested again due to previous problems in order to ensure that the information will be correct when published in the conference proceedings. The second part of the form, in Figure 25,

Paper / POC Author Information

Enter Your Assigned Paper Tracking Number:

Please enter the following information for **only one author**. This should be the author who will be acting as the primary Point of Contact (POC). You will be able to add more authors on the next form. Carefully check the email address, fax and mailing label fields to ensure proper receipt notification. The mailing label should contain a complete address (including name and affiliation) exactly as it would appear on an envelope addressed to this author. The phone numbers are optional. This information must be correct. It will be used in the final publishing of your paper and will not be edited by the conference secretariate.

Title:

*other Title:

Last Name:

First & Middle:

Email Address:

Fax:

Work Phone:

Home Phone:

Affiliation:

Country:

*other Country:

Mailing Label:

Figure 24. Final Paper Submission Application - Top of Paper/Author Information Form

Please enter the following paper information. Do not use all upper case for the title and abstract. This information will be sent directly to the publisher for accepted papers, so please check grammar, format and spelling carefully.

**Paper
Title:**

Abstract:

- Each of the contributed papers for the ISCAS'98 conference has to be presented by "one" of the authors. Please enter the name of the presenter in the Comments field below.
- Please also enter a brief summary of biographical information for the presenter in order for the session chair to introduce him/her.
- Each conference room will be equipped with overhead and slide projectors. If the presenter has any additional audio/visual needs, please enter them also.

Comments:

Password:

(Required for future access & resubmissions!)

Clear Fields

Continue...

Figure 25. Final Paper Submission Application - Bottom of Paper/Author Information Form

collects the "Paper Title" and "Abstract" for publishing. There is also a comments field and a "Password" field which is required to allow the author to have future access to the paper record. Pressing the "Continue..." button submits the data for storage in the database and displays the paper record as shown in Figure 26.

Accurate CMOS Switched-Current Divider Circuits																							
*** Paper Number: 62 ***																							
Point of Contact (POC Author) desires notification by: Email																							
Abstract: This paper presents a highly accurate current divider using switched-current (SI) technique. The circuit accurately divides an input current by two with 3 cycles at each iteration. The accuracy of the division increases as the number of iterations increases. In practice, however, the accuracy is limited due to the clock-feedthrough errors. The issue of accuracy limitation is addressed. The extension to array structures for low-power/low-voltage A/D and D/A converter circuit designs is also discussed.																							
Comments: <div style="border: 1px solid black; padding: 5px; width: fit-content;"> Edit The Above Parameters... </div>																							
Press the "Edit The Above Parameters..." button to change the title, notification method, abstract or comments.																							
Click an Author's Name to edit his/her record. Note: the POC author record cannot be deleted.																							
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">POC</th> <th style="width: 25%;">Author Name</th> <th style="width: 20%;">Email Address</th> <th style="width: 15%;">FAX Number</th> <th style="width: 20%;">Affiliation</th> <th style="width: 10%;">Country</th> </tr> </thead> <tbody> <tr> <td><input checked="" type="checkbox"/></td> <td>Dr. Chin-Long Wey</td> <td>wey@egr.msu.edu</td> <td>517-353-1980</td> <td>Michigan State University</td> <td>USA</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>Mr. Jin-Sheng Wang</td> <td>wangsins</td> <td></td> <td>Michigan State University</td> <td>USA</td> </tr> </tbody> </table> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> Change POC Add an Author... </div>						POC	Author Name	Email Address	FAX Number	Affiliation	Country	<input checked="" type="checkbox"/>	Dr. Chin-Long Wey	wey@egr.msu.edu	517-353-1980	Michigan State University	USA	<input checked="" type="checkbox"/>	Mr. Jin-Sheng Wang	wangsins		Michigan State University	USA
POC	Author Name	Email Address	FAX Number	Affiliation	Country																		
<input checked="" type="checkbox"/>	Dr. Chin-Long Wey	wey@egr.msu.edu	517-353-1980	Michigan State University	USA																		
<input checked="" type="checkbox"/>	Mr. Jin-Sheng Wang	wangsins		Michigan State University	USA																		
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">Submission Attempt</th> <th style="width: 15%;">Type</th> <th style="width: 20%;">Date Submitted</th> <th style="width: 15%;">Received?</th> <th style="width: 20%;">Date Received</th> <th style="width: 15%;">Confirmation</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Final</td> <td>01/29/1998 14:43:15</td> <td>Yes</td> <td>01/29/1998 14:43:49</td> <td>Pending</td> </tr> </tbody> </table> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> Submit / Resubmit the Paper... </div>						Submission Attempt	Type	Date Submitted	Received?	Date Received	Confirmation	1	Final	01/29/1998 14:43:15	Yes	01/29/1998 14:43:49	Pending						
Submission Attempt	Type	Date Submitted	Received?	Date Received	Confirmation																		
1	Final	01/29/1998 14:43:15	Yes	01/29/1998 14:43:49	Pending																		

Figure 26. Final Paper Submission Application - Sample Paper Record

From within the paper record, an author now has complete control over the information stored in the database for his/her paper. The "Edit The Above Parameters..." button allows modification of the paper information in a form very similar to the one shown in Figure 25. The only difference being an added drop-down menu allowing selection of a POC notification method for acknowledgments. The choices are "Email" (default), "FAX", and "Postal Mail". Clicking on an "Author Name" allows editing and/or deleting of the information for that author using a form nearly identical to the one in Figure 24 (minus the paper tracking number field). Additional authors can be added by pressing the "Add an Author..." button which also uses a form like that in Figure 24. A new POC author can be designated by clicking a radio button under "POC" and pressing the "Change POC" button. Pressing the "Submit/Resubmit the Paper..." button will bring up a form like the one shown previously in Figure 7. Submitting the paper with that form will return the user to Figure 26, which will display a sequential list of submission attempts near the bottom of the form.

After administrative personnel have confirmed the submissions with the acknowledgment application, a new button will appear on the form in Figure 26 which will allow authors to access and read their own papers on-line. Authors can use this option to see exactly how their papers will appear when published. To regain access to their paper records for viewing, resubmitting and editing, authors would click on the link titled "Resubmit A Final Paper / Edit Paper and Author Data" in Figure 23. This would bring up the form in Figure 27, which requires a "Paper Number" and a "Password" to open the record to the form shown in Figure 26. The flow chart shown in Figure 28 provides a graphical overview of the final submission application.

4. The Publishing Phase

This phase consists of the conference registration process in addition to the publishing of accepted papers in the conference proceedings. These two functions are closely related because each of the accepted papers requires registration by at least one author. The registration is to include payment for the conference and any additional paper

Enter your paper number and password to open the paper record.

Once the paper record is opened you may:

- Edit the paper record
- Submit (or resubmit) the paper
- View the paper online (several days after submission) - Requires Adobe Acrobat Reader Plugin
- Edit author records
- Add authors
- Delete authors (POC author cannot be deleted)
- Change POC author designation

Paper Number:

Password:

Find Paper

Figure 27. Final Paper Submission Application - Resubmission/Editing Access Form

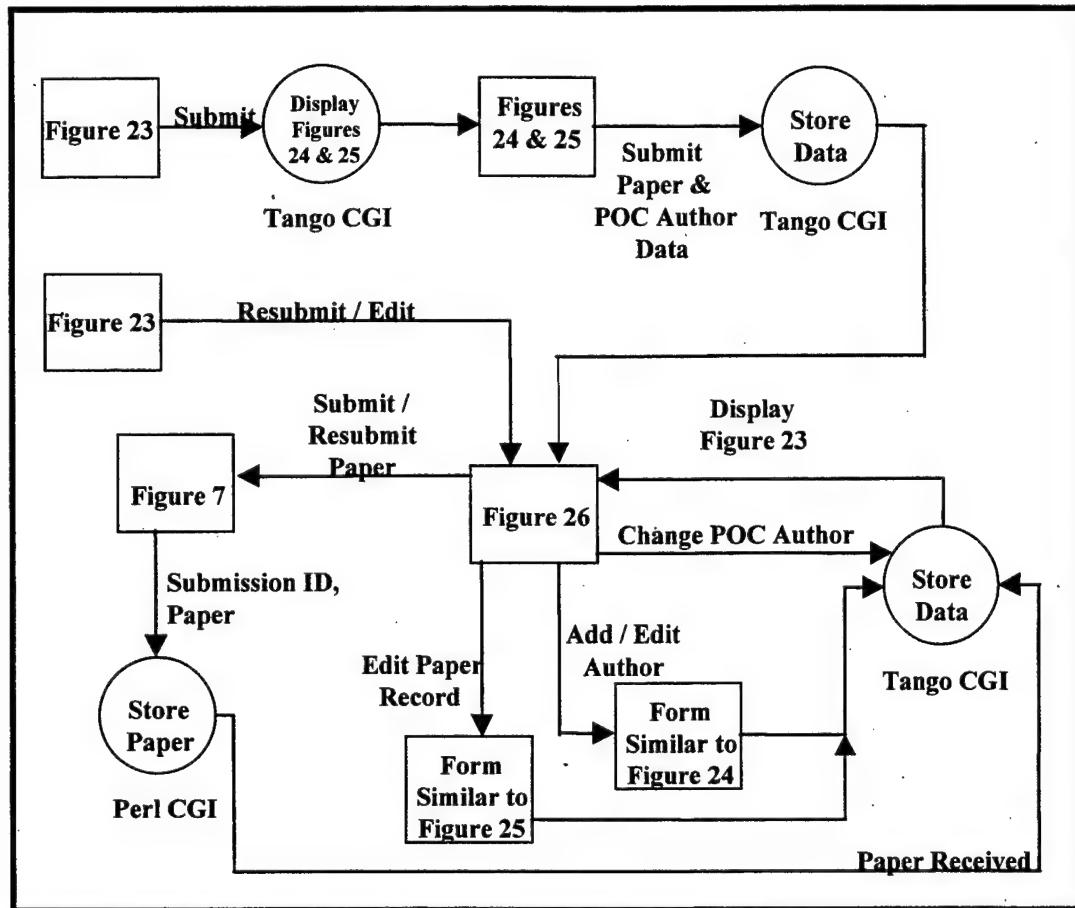


Figure 28. Final Submission Application Flow

publishing costs. Ideally, a paper would not be published if registration and payment for an accepted paper were not received prior to the publishing deadline.

One of the original goals for this prototype was to include an on-line registration application which would be linked directly with the database of accepted papers. This would have provided an automatic integration of the registration and publishing efforts. Time constraints and security concerns for accepting on-line credit card information precluded the development of a registration application; however, an on-line registration capability was provided through an outsourcing contract with a commercial provider. This meant that the two processes would eventually require manual integration. Furthermore, the actual publishing of the papers would, unfortunately, not commence in time to be discussed further in this document. Therefore, prototyping efforts for the functions associated with the publishing phase will be left for future research.

Although only the initial submission and selection phases have been fully completed at this time, the overall prototyping effort has been extremely successful in automating the majority of the ISCAS conference planning functions over the Internet. In the next chapter, specific performance of the prototype will be analyzed and lessons learned will be discussed for those phases which have been completed.

IV. PROTOTYPE ANALYSIS, LESSONS LEARNED AND RECOMMENDATIONS

This chapter discusses the results and lessons learned from the various phases of the ISCAS prototyping effort. Recommendations for overcoming most of the described problems are included. In addition, the final section describes an idealized set of procedures for providing fully automated submission and acknowledgment capabilities in support of an on-line conference planning effort.

A. OVERVIEW OF RESULTS

This section provides an overview of results which could be identified at the time this document was prepared. All four phases of the prototype are listed; however, no results were available for the final submission and publishing phases. The initial submission and selection phases had been fully completed; therefore, specific results could be identified and analysis provided in their respective sub-sections.

1. Initial Submission Phase

Over 950 unique papers (approximately 80% of the total) were submitted for review by authors using the on-line system. Many of the authors for the on-line submissions also mailed in paper copies. Another 250 papers were received by postal mail only. Authors from 62 countries participated. Approximately 98% of all paper acknowledgments were sent to the POC authors via e-mail by administrative personnel using the Tango CGI acknowledgment application. The remaining acknowledgments had to be faxed or mailed due to missing or invalid POC e-mail addresses.

Approximately 30% (555 of 1759) of all paper records in the database were determined to be duplicates which resulted in just over 1200 valid paper records out of the 1759 in the database. This was the largest single problem faced by administrative personnel and lead to longer than expected delays in sending acknowledgments to the authors. Some of the duplicates can be attributed to growing pains with the new on-line methodology. In

particular, many authors failed in their initial attempts and repeated the submission process until they either succeeded or gave up and mailed their papers. Each on-line attempt created a new record in the database. In many cases, the mailed papers resulted in another duplicate record for those papers. Although a paper resubmission option was available, authors often overlooked or misunderstood how to use it, resulting in limited success and adding to the duplicate record problem.

Many authors were not completely comfortable with the on-line process and, therefore, mailed in copies of their papers in addition to their on-line submissions. These added to the problem in cases where an assigned paper tracking number had not been included with the mailed copy. To further aggravate the problem, the delays in acknowledging the papers resulted in even more mailed submissions as authors wanted to take all precautions on their part to ensure that their papers were received. The lessons learned section below will discuss recommendations for avoiding this duplicate record problem.

2. Selection Phase

Well over 2000 paper reviews (100%) were conducted using the on-line paper review application. All of the accepted papers were selected and scheduled into pre-designated conference sessions using the appropriate Web applications. No papers or review forms had to be copied or mailed to distribute them to the reviewers. All reviewers accessed the papers and submitted the reviews using the on-line applications after receiving an e-mail which listed the papers assigned for their review. Other than a handful of reviewers having browser configuration difficulties on their client platforms, the applications built for the review and selection of papers worked as designed with no major difficulties. The selection phase was the most successful in terms of automating the underlying processes and collaborating over the Internet to plan and coordinate for the conference. As a result, there are no significant recommendations for functional changes to the selection phase in the lessons learned section below; however, the manual method used

to group and schedule the sessions for the conference deserves consideration for future research and analysis.

3. Final Submission Phase

Approximately 950 papers are expected to be submitted in camera-ready format during the final submission phase, which is almost identical to the initial submission phase with regard to the process requirements. Consequently, many of the lessons learned from the initial submission phase resulted in significant modifications to the on-line application which would be used for final paper submissions. As of this writing, no results from the final submission process were available; however, preliminary indications are that the new submission application is working as designed. Thus, no additional lessons learned, beyond those from the initial submission phase, will be discussed below. The last section in this chapter does, however, propose additional requirements which could significantly impact this phase as well as the initial submission phase for a future conference.

4. Publishing Phase

This phase had not yet been reached at the time this document was prepared; however, the on-line registration capability had already been established through an outsourcing agreement with a commercial provider. No details or results were available regarding the registration efforts. Additional efforts to explore the processes involved in the publishing phase will be left for future research.

B. LESSONS LEARNED

The major problems encountered during the ISCAS prototyping effort can be broken down into three general areas: excessive duplication of paper records in the database, submission of corrupt electronic files, and communication problems with POC authors. This section discusses the lessons learned in dealing with these problems, most of which came from the paper submission and acknowledgment processes during the initial submission phase.

1. How to Avoid Duplicate Paper Records in the Database

There were several different identifiable causes which resulted in the problem with duplicate paper records. This sub-section discusses the causes and provides a recommended approach to overcoming each of them.

a. Allow Multiple Submissions for each Paper Record

The initial submission application provided limited support for allowing authors to resubmit their papers. Only one paper submission was originally supported for each paper record. The unique database index assigned for each paper record was used as the paper tracking number; therefore, each paper received was named using its database index. For example, paper number 27 was received and stored in the system under the name “27.pdf”. To support a resubmission option, the file upload CGI was modified to name a resubmitted file as “27r.pdf”. Under this system, only two submissions were fully supported for each paper; however, in many cases, more than two submissions were attempted, which resulted in either overwriting previous data or the addition of a duplicate record.

The recommended solution to this problem is to modify the submission application and the underlying database to allow multiple submissions per paper record. This could be accomplished by using a separate submission tracking number to uniquely identify each submission. For example, paper number 27 might have three submission attempts which have been numbered 43, 54 and 67. The database record for paper number 27 would store these three numbers to provide links to the submitted papers. This methodology was implemented in the final paper submission application and preliminary results indicate that it is working as proposed.

b. Provide a Distinct Resubmission Option

Another problem with the initial submission application was its integrated resubmission option. Authors who wished to resubmit had to use the same application and had to re-enter much of the previously submitted data along with their paper tracking

number. Additionally, a radio button designating the attempt as a resubmission had to be selected to prevent creation of a duplicate record. Unfortunately, many authors simply overlooked the button, which was not very prominent on the form. In any event, it wasn't very clear that authors needed to return to the submission application to resubmit.

Providing a separate resubmission function (with its own link) would more clearly indicate how the resubmission process works. In addition, allowing each author to use their assigned paper number in combination with a personal password to access the resubmission application would ensure that each resubmission was attached to the correct paper without requiring all previously entered paper information to be re-entered. To support this, each author would be allowed to enter a password of their choice during the initial submission process. This password would be stored within the paper record and would be used to validate any attempt to access the paper record. This recommended feature was also included in the final submission application.

c. Allow Paper Record Editing by POC Authors

The initial submission application provided no support for allowing authors to recall and/or edit previously submitted paper and author information. One of the initial indicators that this was a problem occurred during initial author interaction with the submission application. Many authors wanted to test the process by running through the submission application once before actually using it. Each test created a useless paper record since the authors could not go back and edit the record. Also, some authors would use their browser's "Back" button to go back to a previous form in order to make changes to submitted information; however, this simply resulted in a new record with the updated information. Further, when authors wanted to change paper or author information from what was previously submitted, they would go through the entire submission process, which would create a duplicate paper record each time.

To overcome these problems, authors would need the capability to edit previously submitted information. The same password and paper number access capability mentioned above could be used to allow authors to edit their paper records. Once the paper

records were accessed via password, an on-line update form could be used to edit the paper and author data. Additionally, a hidden time-stamp could be embedded within the on-line forms to prevent inadvertent duplication through use of the back button. The Tango CGI could use the time-stamp to check for a pre-existing record which could be updated rather than always creating a new one. These editing features and techniques were included in the final paper submission application.

d. Provide Extensive Paper Search Capabilities

The administrative applications originally provided to support the processing of papers received by postal mail did not fully support those papers which had already been submitted on-line. Ideally, any paper, which had been submitted on-line before mailing it, would not be submitted again (creating a duplicate record) by administrative personnel when received. A query capability would be essential in aiding administrators to find pre-existing paper records. The minimal functions which were provided only included the capability to search by paper number or by author's last name. These were not sufficient for two reasons. First, authors seldom included their paper numbers, which were assigned on-line, with the mailed versions. And second, a search by author's last name could result in a lengthy list of records which required administrators to open the records one at a time to compare paper titles.

To provide better administrative support for mailed papers, enhanced search capabilities would be required. The capabilities to search by paper number, by author's last name, and by paper title would all be essential. A sub-string search capability could also be included with the "by author" and "by title" options. Each search would need to display a list of found papers which would include paper numbers and titles for rapid correlation. The search by author function would also need to list the authors' last names. Additionally, the search functions could be made more easily accessible by including them all on the same Web form. These enhanced search capabilities were also included with the final paper submission application.

e. Provide Rapid Feedback to POC Authors

Untimely feedback was probably the most significant contributor to the problem with multiple submissions which resulted in duplicate records. The lack of timely feedback manifested itself in a variety of ways. First, when authors submitted large files via the on-line Web application, no feedback was provided after pressing the submit button until after the file had been completely transferred to the server. Due to the extended delay, many authors felt their might be a problem and would resubmit again and again, creating a new record with each attempt. Second, all but about 100 of the papers submitted on-line were submitted during the final five days before the deadline. This created additional file transmission delays due to the heavy server load which resulted from having the combined Web, database and file upload services all being provided from a single machine (the NT Server). And finally, no formal acknowledgments were sent to any authors until well after the deadline for submissions had passed. This resulted in additional resubmissions as authors wanted to make sure that their papers were received.

To overcome delays and provide better feedback, several steps could be taken. First, the Perl script CGI could be modified to provide a dynamic indication that file upload activity is progressing. It is believed that this can be done; however, a preliminary attempt to modify the Perl script proved unsuccessful. Second, the server activities could be distributed across multiple platforms to minimize server load during peak access times. For example, the Web server, the database server and the file upload application could all be supported by separate platforms. The file upload CGI was ported over to a high capacity SGI server for the final submission phase while the Web and database services remained on the NT server. Additionally, a script could be generated to automatically email a preliminary acknowledgment to the POC author immediately after each submission. Although this capability was not provided in the final submission application, it could serve to reassure authors that their papers had been received and were awaiting verification (at a later date) by administrative personnel. Finally, administrative personnel could acknowledge submissions as they arrived rather than after the deadline had passed.

Unfortunately, personnel resources simply were not available to provide immediate acknowledgments during the final submission phase.

2. How to Avoid Corrupt Paper Submissions

Corrupt files created additional difficulties for administrative personnel during the confirmation and acknowledgment of papers received over the Internet. This sub-section discusses how to deal with the file corruption problem.

a. *Provide On-line Guidance and Support*

Approximately 50 of the 950 papers submitted on-line had some form of font corruption. Almost all of these problems were directly attributable to embedded two-byte fonts which are typical in most foreign language software packages. Received Postscript files containing two-byte foreign fonts could not be converted into PDF files. PDF files received with the two-byte fonts could not be viewed on-line using the English version of Acrobat Reader. In all such cases, administrative personnel had to work closely with the authors to coordinate removal of the two-byte fonts and resubmission of the papers.

Extensive on-line support could help to prevent the foreign font problem in the future. This support could include explicit guidance, examples of on-line PDF files, and links to English versions of the essential software, like Acrobat Reader. Authors could also be directed to Adobe's Web site for white paper discussions on specific technical issues. Finally, an on-line list of frequently asked questions, or FAQ, could be maintained to aid in limiting and/or preventing further corrupt submission problems.

3. How to Avoid Problems Contacting POC Authors

The ability to contact POC authors for sending acknowledgments and notifications was another area of concern with the prototyping effort. This sub-section provides some recommendations to minimize these communication problems.

a. *Allow POC Authors to Choose a Desired Contact Method*

During the acknowledgment portion of the initial submission phase, administrative personnel were unable to send e-mail acknowledgments to the POC authors

for every paper record. Approximately 40 POC authors fell into this category. In each case, either the POC author did not provide an e-mail address or the provided address was invalid. A postal letter or FAX message was used in these situations. To minimize the difficulties which arise in identifying missing or invalid e-mail addresses, POC authors could be required to select a desired method of contact (e-mail, FAX or letter) during the initial submission of their paper information. This would place the responsibility on POC authors to choose a method and to ensure a valid address or number was provided. Administrative personnel could then sort the database into the separate methods and proceed more easily with the acknowledgment process. The final submission application provided this option with "e-mail" set as the default method.

b. *Require POC Authors to Complete an On-line Mailing Label*

Issuing final acceptance notifications required formal letters to be mailed; however, for a large portion of the paper records, incomplete address information had been provided by the POC authors. This led to a significant delay in mailing the notifications since administrative personnel had to verify each address individually for use in a form letter. With the many overseas addresses, this became particularly troublesome when trying to merge the different address fields from a database record into a single address for a label. To avoid this problem, the on-line submission application could require authors to fill out an on-line mailing label, in a single text field, with the address entered exactly as it should appear for a letter addressed to the POC author. This requirement would readily support rapid form letter generation using a mail merge feature, which is built in to most modern word processors. This requirement was also added to and supported in the final submission application.

C. PROPOSAL FOR A FULLY AUTOMATED SUBMISSION PROCESS

This section contains a discussion covering the decisions and actions which would be necessary to support fully automated submission and acknowledgment of papers during both the initial and final submission phases. By completely automating these phases, a

conference planning committee could essentially eliminate the administrative support which currently dominates the personnel and expense resource requirements for managing a conference. In order to completely eliminate administrative personnel requirements from these processes, the entire burden of responsibility for submitting and confirming receipt of papers would have to be shifted to the authors. By taking into account the current prototype's requirements and making some hard decisions, the functions currently performed by administrative personnel could be either eliminated or converted into author requirements. Adding the following requirements to those already supported in the final submission application would provide full automation from the perspectives of the host institution and the conference planning committee.

1. Require On-line Submissions

Every paper would have to be submitted on-line using the submission application. No other form of submission would be allowed. This means that no FAX, no e-mail, no FTP and no postal mail submissions would be accepted. The "First Call For Papers" would make this a clear requirement and no postal address would be provided. This would require authors from around the world to have or to get access to the Internet via a browser in order to submit their papers. Administrative personnel would no longer be required to process papers sent by FTP, FAX, e-mail or postal mail since the information for all papers would be entered into the database and the papers would be loaded to the server by the authors over the Internet.

2. Require PDF Submissions

Every paper would have to be already converted into Adobe's PDF format and would have to be readable using the English version of Adobe's Acrobat Reader application before on-line submission. Since the PDF format includes compression and encoding appropriate for use over the Internet, no other compression or encoding scheme would be applied to the PDF files before transmission. Accepting only PDF submissions would require all authors to have or to get access to Adobe's Acrobat Exchange software in order to convert their papers into PDF format prior to submission. Although this requirement

potentially imposes an added expense on authors, the gains on the administrative side would be enormous. Administrative personnel would no longer have to decode, decompress or convert received papers into the PDF format. Also, no scanners and no printer would be required. Most importantly, as will be discussed later, administrators would no longer be required to confirm the condition nor acknowledge the receipt of submitted papers.

3. Require a POC E-mail Address

Every POC author submitting a paper would have to provide a valid e-mail address. Acknowledgments and preliminary notifications would only be sent by e-mail to the POC authors. No postal or FAX messages would be provided. The "First Call For Papers" would also need to list this requirement along with other submission requirements for prospective authors. This would require all POC authors to have or to get an electronic mail account to participate in a conference. Authors would need to carefully enter their e-mail addresses to ensure they could be contacted when needed. The on-line paper record would have to allow author editing of the e-mail address field to support address changes. A test feature could be included which would allow authors to click a button to have the server automatically send them a test e-mail message within a certain period of time. As a fallback communications measure, acknowledgment and acceptance notification information could be automatically stored in the database and displayed from within on-line paper records. This would require POC authors to access their paper records on-line to receive the messages.

4. Automatically Acknowledge Each Submission

Every single attempt at submitting a paper would require an automatically generated and transmitted e-mail message to the POC author. In addition to validating the POC author's e-mail address, this acknowledgment message would include all identifying paper and author information. Consideration could be given to also including the password entered by the author so that the message would contain all essential information required for regaining access to the paper record in order to perform editing and/or future resubmissions. Also included would be instructions for accessing the actual PDF paper to

confirm its condition by simply opening and reading it on-line using the English version of Acrobat Reader. In addition to eliminating manual acknowledgments, this requirement would also eliminate administrative confirmation of paper conditions because authors would be responsible for submitting and confirming receipt of their own papers. Allowing authors to view their papers exactly as they would appear to reviewers would serve to indicate that the papers were, in fact, successfully uploaded. Papers could be resubmitted if authors did not like the appearance or could not open their papers on-line. A major advantage in allowing authors to confirm their papers is that they are much better judges of how their work should look than administrative personnel who would only be able to confirm that the papers were readable, but could not validate the actual content. An added benefit would be that the number of resubmissions would probably decline as a result of the rapid feedback and the authors' direct involvement in confirming their submissions.

5. Use the Paper Receiving Directory as the On-line Directory

The same file directory used for receiving papers would have to be used as the on-line paper directory which provides Internet access to the submitted papers. Without this requirement, an administrator would have to move the received papers into the on-line directory on a regular basis in support of the automatic e-mail acknowledgments described above. With this requirement, authors would be able to access their papers after each submission. In fact, authors would be able to confirm their papers immediately after submission by providing them with on-line access instructions at the conclusion of their file transfer. This would provide even faster feedback and would further reduce the probability of additional and unnecessary resubmissions because authors would be able to complete their submission and confirmation requirements in a single on-line session.

6. Use a Dedicated Server Exclusively for the Papers

To properly support a fully automated paper submission process, a dedicated server would be required to receive and distribute submitted PDF papers. The file upload CGI (the Perl script) would have to run on this server in conjunction with a Web server to support receiving of the papers. The Web server would also provide on-line access to the received

papers. The requirement to separate the paper server from the database server would more efficiently distribute the increased load which would result from allowing authors to read their own papers on-line. All authors would upload their papers for submission and download their papers for confirmation which would essentially double their paper server access requirements. The high probability that most paper submissions would occur right before the deadline (as with the ISCAS conference) serves to highlight the necessity of this requirement. The server distribution would prevent the higher bandwidth requirements from the actual submission and confirmation of papers from interfering with the submission of paper and author information into the conference database. Furthermore, the server distribution would support the paper review process equally well since the paper server would provide reviewers with access to the papers while the database server would handle the receipt and processing of the on-line review forms.

7. Automatically Disable Paper Submissions at the Deadline

When the paper submission deadline is reached, new paper submissions would have to be automatically disallowed. This would require displaying some form of a "Deadline has Passed" notice when the submission application is accessed. Resubmissions would be allowed for an additional period of time to ensure that all last minute submissions could be confirmed and/or resubmitted if necessary. Both the submission deadline and the resubmission deadline could be controlled via preferences stored in the database which could be set or modified using a system preferences application (which would also be available on-line). Without this requirement, administrative interaction would be necessary to disable the submission and resubmission applications when the deadlines passed.

8. Provide Extensive On-line Help

To ensure that the submission and acknowledgment aspects of the initial and final submission phases remain fully automated with no administrative support would require an extensive use of on-line instructions and help files. The author requirements would have to be clearly described. Links to other resources, like Adobe's Web site, would also be helpful. In addition, an automated password retrieval function would be essential. To

provide this capability, an application could be developed which would allow an author to submit a form containing a paper number to request a forgotten password. For security reasons, an e-mail message containing only the retrieved password would be automatically generated and transmitted to the e-mail address of the POC author on record for that paper. With more on-line help provided in the form of instructions, recommendations, technical information and technical support, administrative personnel requirements will decrease accordingly.

Although the above proposal for a fully automated submission process is fine in an ideal sense, it may be unrealistic at this time to mandate that authors only submit papers in PDF format and that they have Internet access with a valid e-mail address. Conference organizers are interested in achieving high levels of participation and excessive requirements may threaten participation goals to some degree. The ISCAS conference, for example, achieved a world-wide level of participation. In fact, most authors were from foreign countries and, in some cases, did not have Internet access or e-mail accounts available for their use. In these cases, authors were only allowed to participate as a result of the postal submission option.

Over time, advances in modern technology throughout the world should diminish the potentially negative impact of these automated on-line submission requirements and might, in fact, increase participation levels as a result of the increased accessibility. In the near term, however, a system which does enforce the automated requirements could be tested during a local or U.S. only conference in which it could be reasonably assumed that potential participants would easily meet the extra requirements. In the next chapter, conclusions for the research questions which provided the focus for this thesis will be addressed and recommended areas for future research will be described.

V. CONCLUSIONS

The ISCAS '98 conference management prototype demonstrated that conference organization can be effectively accomplished over the Internet. It further showed that an on-line collaboration system encourages participation of internationally dispersed correspondents by providing an additional, near real-time means for communication. This final chapter will address the research questions originally targeted by the ISCAS prototype in order to summarize all conclusions which can be provided from the prototyping effort. Also included is a section on recommended areas for future research.

A. RESEARCH QUESTIONS

1. Which Conference Processes can be Web-enabled?

a. *Paper Submission and Acknowledgment*

The electronic submission of papers during both the initial and final submission phases is a process which is fundamental to any Web-enabled conference planning effort. Use of the Internet to support on-line paper submissions, which are linked directly to a database, provides extensive capabilities for tracking, sorting and managing the various data for later processes (like review, scheduling, registration, and publishing). Additionally, the use of a Web-enabled acknowledgment application allows administrators to prepare and transmit (via e-mail) paper submission confirmations with database information that is automatically merged into an on-line form letter.

b. *Paper Review and Selection*

Web-enabled processes can also support the efforts required to complete the review and selection of papers by the Technical Program Committee (TPC). Enhanced collaboration capabilities result from the integration of a Web server with a database of proposed conference papers. A Web application can interactively distribute the papers over the Internet to the reviewers and then collect their acceptance recommendations using a

Web form. Another Web application can then be used to summarize the information from the review forms for use by the TPC in making a final decision to accept or reject each paper.

c. Presentation Scheduling

The collaborative efforts required by widely dispersed TPC members to schedule accepted paper presentations into predetermined conference sessions can be significantly eased with an on-line scheduling application. With a database already containing all of the paper information (title, authors, etc.) and all of the pre-designated session information (dates, times, etc.), a Web application can be used to first select an appropriate session and then to assign papers by simply entering paper numbers. The key paper information can then be automatically displayed in the schedule from the database. This scheduling application can also support presentation order assignment and can prevent duplicate scheduling of papers. When scheduling is completed, the database can be used to format and print the final conference schedule.

2. Which Conference Processes are Best Suited to Web Deployment?

a. Paper Review and Selection

Using the Internet as a communications medium for reviewing and selecting papers provides significant advantages when supported by a Web application with an integrated database. For the ISCAS prototype, this was the most successful process built into the on-line application suite. An enormous amount of time and money was saved by not having to copy and mail out the more than 1200 papers to the approximately 200 reviewers who were located around the world. Additional savings were realized with the on-line review forms which were automatically collected and sorted into summaries for the TPC's final selection process. In fact, it worked so well that TPC members did not have to meet in person until after the review and selection process was completed, and then only to identify and arrange the conference sessions. It is important to note, however, that Web-enabling this process would not have been possible without first getting all paper and author

information into a database and also providing electronic, on-line viewable versions of the papers.

b. Paper Submission and Acknowledgment

The processes for submitting and acknowledging papers are also well suited to Web deployed applications. With the ISCAS prototype, the use of an on-line submission application was, in fact, critical for getting information into the underlying database which would be used during the review and selection processes, as well as all later processes. Also, the application used to acknowledge received papers allowed administrative personnel, working from any remote location, to send confirmations by e-mail, thereby resulting in significant savings in postage and handling requirements.

There was a trade-off associated with using the on-line submission application. Supporting a postal submission option in addition to the on-line method provided backward compatibility; however, it also resulted in duplicate submissions from authors who used both methods. This, of course, placed an additional burden on administrators to eliminate duplicates from the database prior to using the acknowledgment application. This problem can be minimized by providing rapid feedback to the authors; however, it cannot be completely eliminated unless on-line submissions are the only option supported. Unfortunately, eliminating the postal option would limit participation to only those who have Internet access and e-mail accounts.

3. What are the Hardware and Software Support Requirements?

a. Web Server

A robust server platform capable of running standard HTTP compliant Web server software is essential; and, in fact, provides the foundation which supports all on-line conference collaboration processes. WindowsNT, MacOS and Unix systems are all viable server platforms which support a variety of hardware alternatives. There are many choices for Web server software as well. As mentioned in chapter two, Netscape Enterprise Web server (free for educational use) was run on an NT server in support of the ISCAS

prototype. Initially, an Apache Web server (free) was being used on a Linux (Unix) based 486 PC. A paper collection and distribution server was later setup on an SGI from Silicon Graphics, which also used a Netscape Enterprise Web server. Finally, a MacOS system running Social Engineering's Quid Pro Quo Web server (also free) was used during development and testing of the final submission application to avoid interfering with the production prototype.

b. Database Server

A data repository is critical to the conference planning effort and is necessary to provide a back-end to the Web server for supporting the on-line applications. Any ODBC compliant database server/application can be used. A Microsoft Access database was used for the ISCAS prototype on the NT server. The database server is only used as a data repository. All database management features (forms, joins, queries, indexing, etc.) are implemented using a middle-ware CGI. Development and testing of the final submission application was conducted using a demo version of the MacOS based Butler SQL database server from Everyware Development Corporation. The application was then loaded onto the NT server and linked to an Access database which used the same schema as the Butler SQL test database.

c. Common Gateway Interface

Two different Common Gateway Interface (CGI) applications are required to enhance the functionality of a Web server in support of an on-line conference collaboration environment. First, a CGI is required to support file transfer (upload) from the authors' machines to the conference Web server. For this, a Perl script CGI was used on the ISCAS server. The second CGI is needed to link the Access database to the Web server in order to support interactive data input and retrieval in addition to all other database management requirements. For the ISCAS effort, Tango for Access CGI (chapters two and three) was used to link with the Access database. Also, a demo version of Tango Enterprise CGI was used on a MacOS system for development and testing of the final submission

application. The Tango CGIs come with a companion application, Tango Editor, which can be used on either WindowsNT/95 or MacOS systems to build the on-line applications. All Tango applications have a common file format which allows them to be universally deployable on any Tango CGI platform (WindowsNT, Unix, MacOS).

d. Other Support

Several additional support resources are required to provide background support for a conference support system. An uninterruptible power supply (UPS) is needed to maintain system reliability and integrity. A tape backup system is needed to safeguard the contents of the Web site, the database, and the uploaded papers. Scanners are needed to convert mailed submissions into electronic PDF format for on-line viewing. A Postscript laser printer is needed to support various printing requirements. Also, Acrobat Exchange software (including Acrobat Distiller) is essential to support conversion of Postscript files into PDF format.

4. Is Scalability an Issue With Regard to Hardware and Software?

a. Platforms and Servers

An on-line conference collaboration environment should be able to scale in accordance with the submission and review requirements necessary to support conferences of varying sizes. This is one of the advantages provided by a Web-based solution. The various conference functions could be supported by different platforms to more evenly distribute and share the load across multiple Web servers. With the ISCAS conference, for example, a 486 PC provided domain name support, limited static HTML Web page support, and mail services. A Windows NT server provided database services, on-line application services, and Web site services. And finally, an SGI provided on-line paper collection and distribution services. Any number of platforms running Web servers and CGIs can be integrated into a linked Web farm to support a variety of conference collaboration services. For small conferences, all services can easily be provided from the same platform.

b. Middle-ware

The database middle-ware CGI should easily support the integration of additional conference support processes as needed. Many special purpose queries and/or capabilities will be required during different phases of a conference planning effort. Most of these will be related to retrieving and presenting information from the database. The Tango CGI provided a great deal of flexibility during the ISCAS effort because new applications could be developed and linked to the database independently of other pre-existing applications. This allowed new functions to be easily added to the conference application suite. Additionally, the Tango applications could link to any ODBC compliant database on any platform on the network, even to multiple databases from within the same application. This provides even greater flexibility for distributing services across multiple platforms and could play a significant role in providing secure on-line conference registration services. Unfortunately, time constraints prevented integration of a secure registration server for the ISCAS conference.

c. Data Repository

Adding new functions or processes in support of conference collaboration will require a database system with a flexible schema. A database must be able to support new data storage requirements as they are identified without impacting existing data and the applications which use them. For this reason, a relational database is well suited to a conference planning system, especially during prototyping. With a relational database, new tables can easily be added and linked to existing records using the indexes from other tables. This allows internal data structures to be scaled to meet requirements without affecting existing data. A flat-file database cannot be modified as easily since the addition of new data fields will require modifications to all existing records. Object oriented databases might provide additional flexibility; however, the technology is relatively new, so analysis in this area is left for future research.

5. Are There Any Special Considerations for a Web Deployed System?

a. *Stateless System*

A standard Web server maintains no information between client connections. Each Web page that is accessed by a client starts a new connection with the server. Applications which run through a Web server, therefore, cannot store state information as they progress from page to page. This presents a problem when attempting to track a client's progression through an on-line process; therefore, special care must be taken when developing Web-based applications to ensure that state information is maintained between connections. The stateless application problem can be overcome through the use of "browser cookies" which store state variable information in a client's browser and through the use of hidden HTML input fields which can be embedded within on-line forms. Both of these techniques are employed throughout the ISCAS prototype to track user progression through the series of forms which compose the on-line applications.

b. *Client Configurations*

Developing applications to run over the Internet from a Web server requires consideration for all potential client browsers and their respective configurations. For the ISCAS prototype, this was particularly true with respect to proper functioning Web forms and accessibility to on-line PDF papers. Some older browsers would not properly display Web forms containing tags based on newer HTML standards; therefore, recommended browsers had to be listed on forms where advanced HTML features were essential. Also, browsers had to be properly configured with the appropriate plug-in software (Acrobat Reader) in order to access the on-line PDF papers. Several reviewers had to update their browsers and configure them with the proper plug-ins to complete the on-line reviews. To minimize browser configuration concerns, Web pages and applications should be tested using as many different browser and client platform configurations as possible.

c. International Scope

When International participation is expected, an Internet based electronic collaboration system will result in some communications incompatibilities. With the ISCAS prototype, use of two byte fonts was a problem with many international paper submissions. Although the papers were written in English, the font systems used in many International word processors use two byte fonts that are incompatible with the single byte fonts in English versions of the software. Administrative personnel had to work closely with the authors of these papers to have the two byte fonts removed and to get the papers resubmitted in time for the review process.

B. SHIFTING THE BURDEN OF RESPONSIBILITY

The ultimate success of an on-line conference management system depends heavily on successfully shifting the burden of responsibility for administrative functions from conference administrative personnel to the authors who submit their papers for review. The authors have a vested interest in actively accepting additional responsibility during the initial and final submission phases. Since their objective should be to get their papers accepted and published, it is to their advantage to be proactive during these phases provided they are given appropriate guidance and access to the tools needed to support their efforts. At a minimum, the authors must be provided with the following capabilities:

- The capability to enter their paper and author information directly into the conference database remotely via the Internet
- The capability to electronically submit their papers via the Web
- The capability to have protected access to their paper records
- The capability to edit all information in their paper records to ensure its validity
- The capability to resubmit their papers as many times as necessary to ensure a valid submission is available for review

- The capability to acquire rapid feedback from their efforts
- The capability to access their papers on-line to validate their submissions by viewing them exactly as the reviewers would during the review process

By successfully shifting the burden of responsibility from a few administrators to, in this case, over 2000 authors, an on-line conference support system provides significant leverage to the conference planning and management effort. In fact, the more responsibility is shifted to submitting authors, the more automated the system can become from the conference planning perspective.

C. AREAS FOR FUTURE RESEARCH

1. Scheduling, Registration and Publishing

The ISCAS prototyping effort did not run to completion prior to publishing this thesis. As a result, the registration and publishing processes will be left for future research either with the ISCAS prototype or as part of another conference planning effort. As discussed in Chapter IV, integrating an on-line registration application for conference participants will provide several advantages during the publishing phase. Additionally, determining and implementing the specific requirements in support of an actual publishing effort would provide a more complete analysis for an on-line conference collaboration system. Also, the manual process used to identify and schedule the conference sessions warrants close evaluation. Ideally, the process could be constrained in a manner which would allow it to be converted into an on-line process. This would eliminate the requirement to have the TPC hold a two day scheduling meeting, which was rather expensive considering that most TPC members had to be flown to Monterey.

2. Fully Automated Submission and Acknowledgment

The final section in Chapter IV discusses some of the requirements necessary to support the development of applications which could provide full automation of the submission and acknowledgment functions during the initial and final submission phases.

Along with mandatory Internet and e-mail access, having authors submit their papers in English PDF format is one of the primary requirements for supporting full automation. Although it places the most difficult and/or expensive burden on prospective authors, mandating the use of Adobe's PDF format for electronic paper submissions provides the most flexibility for an on-line conference support system and the greatest benefit to the conference planning committee. A great opportunity for a future research project would include using this requirement, in addition to the others described in chapter four, to develop a fully automated application suite for conference planning.

3. ODBMS Conference Collaboration System

The use of Object-oriented Database Management Systems (ODBMS) is on the rise. They represent the latest advances in database technologies. ODBMS systems have enhanced capabilities for storing non-standard data types, like multimedia objects. Building a conference collaboration system on top of an object-oriented database, as opposed to a relational database, would allow for storage of the PDF papers directly within the database. This could enhance the security and handling capabilities for storing and retrieving the papers. Further, this could provide significant advantages during the publishing phase, which currently will require papers that are stored in a directory to be correlated to their respective database entries before publishing. Also, the paper upload CGI, in addition to paper resubmission and file renaming requirements, would be completely eliminated since the database middle-ware would handle the task of storing the paper in the database where it would coexist with all related paper and author information. An ODBMS conference planning system would be an outstanding research project for anyone interested in learning about object-oriented databases and Web technology.

4. Sealed Bidding and Other Government EC/EDI Processes

The fundamental ideas and experiences gained from the ISCAS prototype can be abstracted into other applications of Internet/Intranet processes, especially those related to Electronic Commerce / Electronic Data Interchange (EC/EDI). The DoD's sealed bidding process and other highly formalized Government processes are ideal for Web-based

implementation. In particular, sealed bidding provides an excellent opportunity for future research by an acquisition professional with an interest in Web development. The attached appendix contains a previously written document based on the ISCAS prototype which describes a DoD EC/EDI model for implementing an Internet browser-based sealed bidding process. It provides a solid foundation for beginning a future research project in this area.

**APPENDIX. A MODEL FOR ELECTRONIC COMMERCE / ELECTRONIC
DATA INTERCHANGE (EC/EDI) IMPLEMENTATION WITHIN FEDERAL
ACQUISITION SYSTEMS: AN INTERNET BROWSER-BASED SEALED
BIDDING PROCESS**

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Abstract: Most Federal EC/EDI initiatives rely on developing a new infrastructure to support the exchange of EC information. With any new communications architecture, systems integration and compatibility issues become a major concern. Additionally, undesirable restrictions are commonly placed on both Government and vendor organizations. The use of existing open data standards and the Internet architecture provides an alternative framework for EC/EDI implementation within Federal acquisition systems. A prototype was developed for the 1998 IEEE International Symposium on Circuits and Systems (ISCAS) to demonstrate and evaluate the use of Internet technology in providing an automated system for global information exchange and collaboration [Ref. 7, p. 1]. The ISCAS prototype is used as a model for describing a web-based sealed bidding process which addresses the objectives and intent of EC/EDI initiatives without incurring the problems and penalties associated with a new architectural solution.

1. Introduction: The 1993 National Performance Review noted that Government must strengthen and broaden its EC/EDI capability, especially within Federal acquisition systems [Ref. 10, p. 39]. Electronic Commerce (EC) is the paper-less exchange of business information using electronic data interchange, electronic mail, electronic bulletin boards, electronic fund transfers and other electronic processes and technologies. Electronic Data Interchange (EDI) is the computer to computer transmission of a business document in a standard format [Ref. 9, pp. 15-16]. It is generally accepted that EC/EDI provides a significant advantage to those who incorporate it into their business models. The Federal Government develops and maintains standard forms and documents which are typically used in paper format to conduct most or all Government related business transactions. These standard documents readily lend themselves to use in an electronic format within the EC/EDI context.

2. Functional Requirements of the EC/EDI Process: In order to establish an EDI process, the information contained within a standard business document must be formatted into standardized, machine-processable data fields. These data field formats must be agreed upon and shared between all organizations which desire to participate in the EDI process. Furthermore, each organization must acquire or develop software applications which are capable of supporting the business field formats on the systems contained within their

organizations. Once the data standards are in place and applications for processing the data are available, transactions can be conducted between the participating organizations by electronically transmitting standard business document formats [Ref. 11, p. 13].

The electronic transmission of standard business documents requires some form of a communications link. Existing EC/EDI initiatives routinely support one of the two common approaches for providing an electronic communications link in the commercial industry: the "direct connection" method or the use of a "Value Added Network (VAN)". The direct connection method allows trading partners to transmit business data directly between their computers via commercial phone lines (modem to modem). The EDI VAN is a communications network that transmits, receives, and stores electronic business documents for EDI trading partners in a process which is similar to the use of an electronic mailbox. Using the VAN approach requires an additional communications architecture which alleviates most of the access restrictions inherent in the direct approach. The Department of Defense (DoD) has adopted a modified VAN concept for internal use which uses two Network Entry Points (NEPs) to allow all DoD activities to pass their EDI transactions through the Defense Information Systems Agency (DISA) to the commercial VANs that have registered with the DoD [Ref. 8, pp. 21-22].

3. Problems with Current Federal Initiatives: The use of an EC/EDI process within Federal acquisition systems should provide for full and free dissemination of acquisition information to the public, which includes all business concerns (large and small). Additionally, the EC/EDI process should not unintentionally exclude any public interest from participating in Federal acquisition business activities. With respect to technical feasibility, the entire public should have ready and easy access to the process without being encumbered with expensive, non-standard software and hardware systems acquisition and integration issues. By supporting these criteria, an EC/EDI acquisition process would help the Government maintain the competitive pricing advantages which are associated with a fully open and fairly competitive market. Presently, there is an architectural limitation of information, which creates an information barrier to entry, limiting competition [Ref. 9, p. 116]. The following is a list of issues and concerns which are disadvantageous to the Federal acquisition process with regard to existing EC/EDI initiatives:

- a. The direct connection approach is only viable for activities doing business with just a few trading partners. An activity must schedule times for its partners to access the computer for transaction exchanges. As the number of partners and volume of transactions grows, the direct connection method becomes restrictive, cumbersome and expensive. For this reason, it is not a viable option for Federal acquisition activities [Ref. 9, pp. 21-22].
- b. The DoD VAN concept has created great concern with DISA's inability to efficiently process the existing volume of DoD EDI transactions in a timely or consistent manner [Ref. 8, p. 23]. A significant amount of systems architecture

overhead has been added to the process. Additionally, the NEP concept provides a significant bottleneck which will deteriorate rapidly as more DoD activities begin using EDI. Any delays in processing EDI transactions will jeopardize competitive fairness, especially in regard to the issue of electronic bids and other time sensitive EDI transactions.

- c. The VAN method requires that all business entities desiring to conduct EDI transactions with a Government agency be registered with a VAN which is in turn registered with the Government agencies' VAN [Ref. 8, p. 23]. The use of VAN services is an added expense to the public business entity. This can have the unwanted effect of excluding small business concerns, especially those which would need to be registered with multiple VANs in order to conduct EDI business with multiple government agencies.
- d. There are numerous data standards in use for EDI transactions, with most activities using standards that are tailored to their transaction databases. This forces trading partner activities to use (share) the same data field standards. Since, as mentioned above, each activity must have applications which can work with the data, a significant cost is usually required for trading partners to develop special purpose EDI applications [Ref. 8, pp. 31-33]. This added expense can easily become cost prohibitive for small businesses, especially if more than one application is required to transact with more than one Government activity. There are additional life-cycle maintenance costs associated with these special purpose software packages. This has the added drawback of creating legacy (stove-pipe) systems which make it difficult for either the Government activity or the trading partners to upgrade their hardware/software configurations or to migrate to other platforms [Ref. 8, pp. 52-53].

4. The Internet as an Alternative EC/EDI Communications Link: As much as the Government desires to uphold the sanctity of full and open competition in procurements, there should be a parallel full and open access to information. Such a conduit to information not only promotes full and open competition but also abides by the full intent and objectives of EC/EDI [Ref. 9, p. 116]. The Internet is an inexpensive (cheap) communications conduit which provides almost universal access. It is based on standard protocols which are widely accepted in the commercial sector. Most businesses already have (or will soon have) Internet access. The browser software which is used to interact with the Internet is freely available to any user.

Internet browser applications are based on a standard data formatting syntax known as HyperText Markup Language (HTML). Any individual or activity can create a web-site full of HTML documents (using any text editor) which can then be read by anyone using any standard browser application from anywhere on the Internet. A web-site requires another HTML-based standard software application, a web-server, which transmits the

HTML documents to all requesting clients (users with standard web browsers). A good web-server can easily support thousands of clients simultaneously. High quality browser and web-server applications are commercially (and often freely) available for all existing computer systems.

As described above, a web-server typically only disseminates information to requesting clients. This is essentially a one-way communications link which does not fully meet the fundamental need for two-way EC/EDI communications. In fact, existing Federal Internet-based EDI initiatives tend to rely on web-servers solely for distributing information rather than also for collecting and processing data from clients [Ref. 9, pp. 118-120]. In order to collect data for a Federal acquisition process, the received client data requires security, integrity, time validity, client authentication and non-repudiation. In Implementing Electronic Data Interchange (EDI) at the Defense Fuel Supply Center, James M. Barnard discusses several techniques and methods which are now commonly used to resolve these client data requirements [Ref. 8, pp. 23-29]. In Addition to supporting these methods, an Internet-based bi-directional EC/EDI web-server must also be capable of retrieving the data from the clients.

The HTML standard also provides syntax for creating electronic forms which accept input data from clients (via a browser application) for processing by a web-server middleware application. The typical web-server is only capable of receiving, not processing, the submitted form data. Two more software applications are required to complete the EDI communications link. A Common Gateway Interface (CGI) application is needed to process the received data; and a database application is required to store it. The web-server will pass received form data over to the CGI. The CGI will process it, store it in the database and generate an HTML response document which will be passed back through the web-server to the client. Database applications and fully configurable CGI (middleware) applications are also commercially available. Higher quality commercial CGIs are capable of interacting and working directly with most existing database systems used within Federal activities. It is important to note that all additional software requirements are placed solely on the server-side (Government) activity for an Internet-based EC/EDI solution. The standard HTML browser application is the only application required by the clients. Thus, a data-base enabled government web-site may provide a viable alternative to existing EC/EDI initiatives which does not incur the problems associated with the development of a new communications architecture.

5. The Sealed Bidding Process: Developing a web-site to manage a local sealed bidding process would provide an ideal prototype for demonstrating the advantages of an Internet browser-based EC/EDI process. Such a prototype could easily be converted into a turn-key web system which is transportable and easily installed at any contracting activity on existing computer systems with Internet access. It is the formality of the sealed bidding process, as in many Government processes, which lends it to an EC/EDI implementation. Under the Competition in Contracting Act (CICA), procuring agencies are required to

procure "competitively." The Federal Acquisition Regulation (FAR) closely governs the rigid requirements of the sealed bidding process. Its basic objective is to give all interested parties an opportunity to deal with the Government on an equal basis – with the Government theoretically reaping the benefits of full and open competition [Ref. 12, p. 3-2]. An Internet solution better supports this basic objective than do other EC/EDI communications frameworks.

A sealed bid procurement begins with an Invitation for Bids (IFB), which is a collection of forms that includes instructions for bidders to follow, certifications to be signed, prices to be filled in, the technical requirements or specifications of the procurement, and both standard and special terms and conditions. The IFB is required to be distributed to a sufficient number of prospective bidders to ensure adequate competition. This is typically done with public displays, announcements and through the use of prospective bidders mailing lists. Any interested bidder can register for inclusion in these mailing lists. Mailing lists are currently the most effective means for publicizing a solicitation of bids. Although a long mailing list typically generates more competition, it also generates a significant mailing expense for the solicitation [Ref. 12, pp. 3-13,16]. Once potential bidders have received their bid packages, the forms (bids) are completed and returned prior to the stated deadline. Late bids are rejected unless they can be considered for award under the late bid rules. At the pre-designated time, the Government's bid-opening officer opens and, when possible, reads aloud the most important terms of each bid. An abstract of all bids is prepared, which includes the bidders, their bids and other price-related factors which will be used to make the final bidder selection. All bids are then made available for public inspection. Award of contract is made to the responsible bidder who submits the lowest responsive bid. This entire sealed bidding process folds easily into an automated electronic bidding system which scales well with both the Government contracting agencies and the prospective bidding organizations.

6. A Sealed Bidding Model for Internet EC/EDI: An electronic collaboration system has been developed which parallels many of the functions inherent in the sealed bidding process. This system is being used at the Naval Postgraduate School as a working prototype to coordinate and manage the IEEE's 1998 International Symposium on Circuits and Systems (ISCAS '98). The entire set of ISCAS conference processes is available on the Internet to provide a world-wide collaboration environment for the widely dispersed members of the committee and all conference participants. Although the ISCAS prototype does not currently support secure EC/EDI, it does provide a fundamental framework from which a comparative sealed bidding model can be abstracted (especially with the known ability to easily incorporate secure form processing into a web-site).

The objective of the ISCAS '98 prototype was to pipeline, into a single on-line system, all of the traditional conference organization processes - particularly those related to receiving, processing, acknowledging, distributing, reviewing, accepting and scheduling papers submitted for conference presentations. In a typical conference, a first call for papers is

developed. The nature and objective of a first call for papers is not unlike that of an IFB (in relation to the respective functions of each). A first call for papers asks for paper submissions, discusses the submission requirements (including format), provides a preliminary list of topics, delineates a schedule (including deadlines) and describes the proper procedure for paper submissions. In a manner similar to bid solicitation, authors' mailing lists (maintained by IEEE) are used for notifying potential authors and institutions of a pending conference by mailing out a first call for papers. Authors then submit their proposed papers for review by mailing them to the conference organizing committee at the host institution. The papers are received, verified, recorded, sorted and an acknowledgment of receipt is mailed to each author. As in the bid submission process, submitted papers are withheld from review until the deadline (bid opening) has passed. (*At this point, the ISCAS and sealed bidding processes diverge in similarity, however, minor abstraction from existing on-line methods will allow visualization of a complete sealed bidding EC/EDI model.*) Copies of the papers are then mailed out to the various reviewers for an acceptance recommendation. Completed review forms are mailed back to the organizing committee and a final acceptance determination is made. The accepted papers are then scheduled into related presentation sessions for the actual conference.

A first call for papers (*think IFB*) was published on the ISCAS '98 web site (<http://www.iscas.nps.navy.mil>) in HTML format for easy access via the Internet. Another electronic version of the first call for papers was also placed online in PDF format to allow for download and off-line viewing. Postal mail was used to distribute a paper version of the first call for papers, which directed potential authors (*think prospective bidders*) to the web-site. In future versions, technology will allow automated notification of a pending conference by automatically emailing notices to the entire authors' mailing list (stored in an on-line database) at the time of a first call posting. The objective is to direct authors' attention to the web-site. As authors become more familiar and comfortable with the process, they will begin to instinctively check the site for pending conference information (*solicitations*).

On the web-site, approaching deadlines are highlighted in a rotating banner at the bottom of the screen. Hyper-links are provided to all of the requirements as well as to an online form which allows for Internet browser-based paper submissions (*think sealed bids*). This form is actually the first in a series of forms which capture the required identification and contact information along with author preferences for presentation method and paper topic / sub-topic categories. A time-stamp is automatically entered into the database along with the form data to record submission time. A unique tracking number is auto-assigned to the paper and returned to the author for future reference via an HTML results document. The final form allows an author to interactively select a paper to be submitted from a local hard disk. A "Submit" button is then pressed which transfers the paper (using the HTTP protocol) to the web-server. The web-server passes the incoming file over to a CGI which saves the file to a designated partition (protected) on the server. Although not fully

exploited in the ISCAS prototype, current technology allows auto-conversion of the incoming file into an Adobe Acrobat PDF file for online viewing (if it is not already in Acrobat format). A final HTML results document is then sent to the author to confirm receipt and to redisplay the paper tracking number for the author's future reference to the paper submission.

The paper submission now requires validation to ensure that it has been received in good condition (non-corrupted) and that it has been converted into a PDF file. Validation is conducted by administrative personnel who are not members of the ISCAS committee or review personnel. Online readability of the electronic paper is the only concern (not content). (*It is important to note that this step would not be required for a sealed bidding process. All sealed bid information could easily be obtained via machine-readable standard form fields rather than from a PDF document. If a PDF file were required, a method for on-line validation by the submitting bidder is an available option. This would allow a bidder to verify his/her own submission by opening the bid on-line immediately after transmission to prove that it was received intact. Security features are available to support this technique.*) A successful validation results in an auto-generated email acknowledgment to the author, which identifies the paper by title, category, author(s) and paper tracking number. An invalid submission results in a negative email acknowledgment which warns the author (*bidder*) to resubmit using the same tracking number. Valid submissions are then transferred into a protected on-line directory to await the submission deadline (*bid opening*) which signals the start of the review process. When the deadline for submissions is reached, the paper submission application is taken off-line. This eliminates problems associated with late submissions (*late bids*) by simply disallowing them. The capability to completely automate this deadline action is available, although it was not used to terminate the ISCAS '98 submission application.

The paper review process begins by allowing protected, log-in access (via assigned passwords) for the paper reviewers. The reviewers are then emailed a list of assigned papers to be reviewed. An on-line review form is available which has a direct link to the paper being reviewed. The papers can be reviewed over the Internet using the Adobe Acrobat browser plug-in (free).

As stated before, the review portion (as well as the remainder) of the ISCAS process is different from the sealed bidding process; however, the parallel to be drawn is that the papers are made available on-line immediately after the deadline (although access is restricted). With regard to sealed bidding, the bids themselves could be made available for public scrutiny (automatically) at the time set for bid opening. Furthermore, the abstract of bids could be auto-generated, sorted and auto-emailed to the designated "bid-opening officer" who could then access the on-line bids for a more detailed review (if necessary for contract award).

To complete the sealed bidding EC/EDI model drawn from the ISCAS comparison above, an application could be developed to allow on-line award of contract. This application would allow designation and confirmation of the winning bidder by selection of the bid tracking number which identifies the responsible bidder who submitted the lowest responsive bid. The notification process would also be completely automated (via email) for notifying the winner and other bid participants of the award. In addition, an on-line announcement could be auto-generated for public access.

7. Summary: The sealed bidding model described above effectively demonstrates that the existing Internet infrastructure, when combined with open standards (HTML), provides a credible alternative to most current Federal EC/EDI implementations. Unlike current initiatives, which tend to restrict competition, an Internet browser-based EC/EDI process may actually increase competition. The sealed bidding model shows that there are many advantages to an Internet-based solution, including (but not limited to) the following which are particular to sealed bidding, but could easily be extrapolated into other Government EC/EDI processes:

1. An entire Internet-based sealed bidding EC/EDI application suite could be developed in a few weeks using currently available commercial software.
2. The sealed bidding applications could be installed on any Unix, Windows NT or Macintosh based web-server and could then be connected to any existing database system with the requisite data fields.
3. The database system can reside on any platform on any part of the Local Area Network or anywhere on the Internet.
4. Prospective bidders could register for inclusion in electronic mailing lists with the use of an automatic online registration application, which would be included with the sealed bidding application suite.
5. A significantly larger pool of prospective bidders would be able to compete at no added expense to either the Government agency or the bidders.
6. No more expensive postal mailings would be required of the contracting agency in order to distribute IFBs.
7. A sealed bidding web-site would allow for near real-time distribution of IFBs and bid submissions.
8. Bidders could receive instant feedback as to the receipt status of their bid. The HTML results document returned from the CGI could securely display enough information to confirm to the bidder that the bid had been posted in time. In fact, a signed and irrefutable certificate could be returned from the web-server to the bidder. The bidder would need to save the certificate for legal purposes and proof.
9. Bid openings could be automated with instantaneous online publishing of bid information at the exact time specified for bid opening.
10. An abstract of bids could be automatically generated at bid opening time and could be sorted according to price and price related factors.

11. The online database could automatically flag known non-responsible bidders in the abstract of bids.
12. Security and authentication / non-repudiation technologies can be integrated into existing web-servers and web-browsers. Electronic encryption and identification certificates can be registered and plugged directly into the software.
13. The sealed bidding submission application could be configured to automatically start and stop receiving bids at designated times (i.e., automatically stops allowing submissions at bid opening time). This would help in eliminating the late bid problem.
14. Sealed bidding system modifications would only be required on one platform (the web-server). This means that changes would be immediately available to all clients (prospective bidders) who access the web-site after the changes. (Migration and scalability would no longer be a major concern.)
15. Changes in requirements / IFBs can be automatically sent (in near real-time via email) to all bidders who have already submitted bids by simply using the database of existing bids (bidders) to filter the database mailing list.

The ISCAS '98 prototype is a proven system which provides a solid foundation for formulating the sealed bidding EC/EDI comparison and for drawing the above conclusions. There are currently more than 1200 paper submissions on the web-server. There were approximately 2300 contributing authors from more than 60 countries. The various paper reviewing committees totaled more than 200 members from around the world. The review process was completed with more than 2400 electronic reviews submitted. Very little money has been spent on postage by the conference organizing committee in support of the paper submission and review processes.

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